HIGHWAY SAFETY, DESIGN AND OPERATIONS—RESEARCH AND DEVELOPMENT

(100-65)

HEARING

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

OF THE

COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION
HOUSE OF REPRESENTATIVES

ONE HUNDREDTH CONGRESS

SECOND SESSION

JUNE 20, 1988, AT PENN STATE UNIVERSITY, UNIVERSITY PARK, PA

Printed for the use of the Committee on Public Works and Transportation

U.S. GOVERNMENT PRINTING OFFICE

89-337 WASHINGTON : 1988

For sale by the Superintendent of Documents, Congressional Sales Office
U.S. Government Printing Office, Washington, DC 20402

H641-7

COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION

GLENN M. ANDERSON, California, *Chairman*

ROBERT A. ROE, New Jersey
NORMAN Y. MINETA, California
JAMES L. OBERSTAR, Minnesota
HENRY J. NOWAK, New York
NICK JOE RAHALL II, West Virginia
DOUGLAS APPLEGATE, Ohio
RON DE LUGO, Virgin Islands
GUS SAVAGE, Illinois
DOUGLAS H. BOSCO, California
ROBERT A. BORSKI, Pennsylvania
JOE KOLTER, Pennsylvania
TIM VALENTINE, North Carolina
EDOLPHUS TOWNS, New York
WILLIAM O. LIPINSKI, Illinois
J. ROY ROWLAND, Georgia
ROBERT E. WISE, JR., West Virginia
KENNETH J. GRAY, Illinois
PETER J. VISCLOSKY, Indiana
JAMES A. TRAFICANT, JR., Ohio
JIM CHAPMAN, Texas
LOUISE M. SLAUGHTER, New York
JOHN LEWIS, Georgia
PETER A. DEFAZIO, Oregon
BENJAMIN L. CARDIN, Maryland
BILL GRANT, Florida
DAVID E. SKAGGS, Colorado
JIMMY HAYES, Louisiana
CARL C. PERKINS, Kentucky
BOB CLEMENT, Tennessee
LEWIS F. PAYNE, Virginia

JOHN PAUL HAMMERSCHMIDT, Arkansas
BUD SHUSTER, Pennsylvania
ARLAN STANGELAND, Minnesota
NEWT GINGRICH, Georgia
WILLIAM F. CLINGER, JR., Pennsylvania
GUY V. MOLINARI, New York
E. CLAY SHAW, JR., Florida
BOB McEWEN, Ohio
THOMAS E. PETRI, Wisconsin
DON SUNDQUIST, Tennessee
NANCY L. JOHNSON, Connecticut
RON PACKARD, California
SHERWOOD BOEHLERT, New York
DEAN A. GALLO, New Jersey
HELEN DELICH BENTLEY, Maryland
JIM LIGHTFOOT, Iowa
DENNIS HASTERT, Illinois
JAMES M. INHOFE, Oklahoma
CASS BALLENGER, North Carolina
FRED UPTON, Michigan

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

JAMES L. OBERSTAR, Minnesota, *Chairman*

ROBERT A. ROE, New Jersey
NORMAN Y. MINETA, California
HENRY J. NOWAK, New York
ROBERT A. BORSKI, Pennsylvania
JOE KOLTER, Pennsylvania
J. ROY ROWLAND, Georgia
KENNETH J. GRAY, Illinois
LOUISE M. SLAUGHTER, New York
EDOLPHUS TOWNS, New York
BOB CLEMENT, Tennessee
GLENN M. ANDERSON, California
(Ex Officio)

WILLIAM F. CLINGER, JR., Pennsylvania
BUD SHUSTER, Pennsylvania
NEWT GINGRICH, Georgia
GUY V. MOLINARI, New York
BOB McEWEN, Ohio
NANCY L. JOHNSON, Connecticut
HELEN DELICH BENTLEY, Maryland
JOHN PAUL HAMMERSCHMIDT, Arkansas
(Ex Officio)

CONTENTS

TESTIMONY

	Page
Anderson, David A., Ph.D., director, Pavements and Materials Program, Pennsylvania Transportation Institute, Pennsylvania State University, State College, PA	8
Henry, John Jewett, Ph.D., professor of mechanical engineering and director of the Pennsylvania Transportation Institute, Pennsylvania State University, University Park, PA	8
Knouse, Mark, executive vice president, International Barrier Corp., Washington, DC, accompanied by Lincoln Cobb, head of design	50
Mason, John M., Jr., Ph.D., director transportation operations program, Pennsylvania Transportation Institute, Pennsylvania State University, State College, PA	8
Meyer, Professor Wolfgang, retired	8
Miller, James H., Ph.D., director, public transportation program, Pennsylvania Transportation Institute, Pennsylvania State University, State College, PA	8
Thomchick, Evelyn A., Ph.D., director, transportation policy analysis program, Pennsylvania Transportation Institute, Pennsylvania State University, State College, PA	8
Wambold, James C., Ph.D., director, vehicle/surface interaction and safety program, Pennsylvania Transportation Institute, Pennsylvania State University, State College, PA	8

PREPARED STATEMENTS

Anderson, David A., Ph.D	38
Clinger, Hon. William F., Jr	5
Henry, John Jewett, Ph.D	36
Knouse, Mark	58
Mason, John M., Jr., Ph.D	42
Miller, James H., Ph.D	45
Thomchick, Evelyn, Ph.D	40
Wambold, James C., Ph.D	48

HIGHWAY SAFETY DESIGN AND OPERATIONS—RESEARCH AND DEVELOPMENT

MONDAY, JUNE 20, 1988

HOUSE OF REPRESENTATIVES,
COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
University Park, PA.

The Subcommittee met, pursuant to notice, at 1:43 p.m. in Room 114, Paul Robeson Cultural Center, Pennsylvania State University, University Park, Pennsylvania, Hon. James L. Oberstar presiding.

Members present: Representatives Oberstar and Clinger.

Mr. OBERSTAR. The Subcommittee on Investigations and Oversight will come to order.

Over twenty years ago, this subcommittee began a series of hearings focused on improvement of highway safety design and operations on road surfaces throughout our country.

Those hearings, taking place over a seven year period, from 1967 through 1973, represented a milestone in Congressional oversight work. It was the first time a Congressional committee focused on the road surface, the quality of the pavement, the quality of bridges, roadside hazards, highway design itself, and construction materials, with a view towards cost savings and highway safety improvements.

During those years, I was administrative assistant to my predecessor in Congress, John Blatnik, who later became Chairman of the House Committee on Public Works and Transportation. I then served as the administrator of the House Public Works Committee staff.

So, I was intimately involved with those hearings, with the work that the committee had done; and, now, back as the subcommittee's Chairman.

The issues that we debated then, which we were pioneering, literally, are still with us. As we look now to the next phase of our federal aid highway program—roadside hazards, signing on our Interstate, primary and urban highway systems, uniform traffic laws, studded tires, wet weather performance, narrow bridges, driver dilemma areas. All of those problems were highlighted by those early hearings and covered in a Committee report, which later became part of civil engineering courses at universities throughout the United States, and literally changed the way we build and maintain highways in this country.

As Congressman Clinger, the senior Republican on our subcommittee, and I prepared for an extensive set of hearings on highway

construction, design, materials, and new concepts that can lengthen life of existing structures and improve quality of new construction, he suggested having at least one of the hearings here at Penn State, which I agreed to because of your Transportation Institute research program.

I recalled that one of the principal driving forces in our initial set of hearings was a Penn State University professor who is with us today, Professor Wolfgang Meyer. He was then the—it was then called the Pennsylvania Transportation and Traffic Safety Center—Director of the Automotive Safety Research Program. He's still here, still contributing his ideas, still making an impact on highway design and concepts sharing. We're very pleased to have him with us, sharing his wealth of knowledge with the subcommittee.

We have a 161 billion dollar investment, in federal funds alone, in the Interstate, primary secondary and urban highway system in the country. Every year we spend, just federal funds alone, over $14 billion in rehabilitation, restoration and maintenance of our federal highway system.

In a time of budgetary restraints, especially, but at any time, both for safety purposes and for most efficient use of highway dollars, we need to find ways we can best take advantage and use those federal highway dollars.

This hearing today, the initial in a continuing series, will bring to the fore, to the public, to the policy makers, in federal and state governments as well, a wealth of knowledge that is being developed in research centers like this throughout the country.

We are here because this is the premiere research center for transportation, surface materials, highway and bridge design. We come here to learn; and we come here, also, to share your knowledge with the Federal Highway Administration and with your counterparts throughout the United States.

I am a very strong believer in research and development. I have come to learn that research is most successful when a number of investigators are at work, when many minds are applying their innovative genius from different aspects, and when research institutions, including strong state university sponsored research institutions, are at work together, enhancing and cross-fertilizing with each other and with the private sector.

We are looking forward to this hearing today and to receiving the testimony of witnesses from the Pennsylvania Transportation Institute, whom we have already visited with this morning. We have seen first-hand the test site, which is one of the finest I have seen anywhere in the country.

At this point, I would like to call on my colleague, Congressman Bill Clinger, who is the senior Republican member of the subcommittee and who, together with me, has been involved in all of the work of this subcommittee.

I must say that oversight and investigative work in the Congress is best when it is conducted on a non-partisan basis. This subcommittee has been successful because it is operated on that basis.

In Congressman Clinger, I have a partner in the work of the Congress and the work of the American people in best serving the needs of transportation, whether it is aviation, highways, bridges,

inland waterways, ports, or the St. Lawrence Seaway. I am very, very grateful to have his participation, very scholarly and thoughtful participation, throughout the work of the subcommittee.

In conclusion, this visit to Penn State in June is Bill Clinger's appreciation for my taking him to the St. Lawrence Seaway in January to inspect the locks in 5 degrees below zero weather. [Laughter.]

Congressman Clinger.

Mr. CLINGER. Thank you very much, Mr. Chairman. I concur. It is a little more pleasant, I would say, than the day that we had up in St. Lawrence. It was a beautiful day, but it was a very cold one.

Mr. Chairman, I just want to express to you my very deep appreciation for holding this field hearing of the subcommittee here in State College and giving us an opportunity to hear, from the experts at the Transportation Institute, about some of the exciting things they are doing and some of their thoughts on policy suggestions on how we address infrastructure problems, particularly as they relate to transportation.

I am delighted that we are going to have the opportunity to hear today from some of the really top minds in this field.

I would also like to reiterate the suggestion that was made earlier today. That is, that you can find time to return to State College, Happy Valley, this fall for, perhaps, a further examination of infrastructure problems as they might relate to the stadium.

Mr. OBERSTAR. The university stadium construction? Yes.

Mr. CLINGER. You'd like to see that filled, I am sure. So, we hope we can arrange that for this fall.

As you have indicated, the Transportation Institute, from whom we will be hearing this afternoon, has a very long history of involvement in transportation and highway programs and in highway policy—one of the first, really, of the major transportation institutes in the country.

The contributions which the Institute has made over the years have led the way in development of design criteria and construction techniques for our highways and bridges, and in the incorporation of features to improve the safety of the traveling public which, of course, is of paramount consideration when we are talking about highway policy.

Obviously, our economy cannot operate without a safe and adequate transportation network, although sometimes we tended to lose sight of it or tended to put a lesser priority on it than perhaps we should have.

We do know, for example, that our major trading partners are very well aware of the need to maintain adequate public facilities and that their ability to have economic growth is directly related to the quality of those facilities which includes transportation.

Concurrent with new investment, I believe we will rely more and more on transportation research centers such as the institute here at Penn State to meet future needs through ongoing work in materials research, traffic modeling, measurements and other engineering disciplines, and through the training of transportation professionals. I think this is an item that I know we are going to hear testimony on this afternoon: the very real need to maintain that

expertise, the cadre of trained people to address the transportation challenges that we are going to have in the future.

As you and I know, coming from a major urban center which approaches terminal gridlock every morning from 6:00 to 9:00 and every afternoon from 4:00 to 8:00, the challenges are definitely there and getting more challenging every day.

I believe we must also work to achieve a more rapid pace of technology transfer, and to some degree mitigate the risks associated with new technology.

It was brought to my attention on more than one occasion that local officials are very reluctant oftentimes to use new and potentially cheaper alternatives because of the fear of exposing themselves to unknown risks and to unknown liabilities. I think this is a very real disincentive, a real impediment to, in many cases, try new technologies and utilize new materials.

Despite this quandary, I think it has been well proven in industry and government that one of the best investments that can be made is in research and development. Without it, the enterprise is doomed to failure as other forces overtake it and undermine its ability to accommodate new ideas, processes, and increased growth.

So, with that, Mr. Chairman, I would conclude my remarks by just thanking you, again, for bringing the subcommittee to Penn State and to tell the members of the panel that I look forward with great interest to hearing your testimony, to thank you for this morning's visits which I think both the chairman and I have found absolutely fascinating, some of the things that are going on at the Institute, and that we look forward to hearing the testimony of our witnesses.

Mr. OBERSTAR. Thank you. The shoe is on the other foot, however.

The subcommittee is appreciative to you, to Penn State, to all those at the Transportation Institute, for the hospitality and for making your facilities available as we begin this very long inquiry we will be making, a continuous one, into highway construction materials.

[Statement of Mr. Clinger follows:]

STATEMENT OF
THE HONORABLE WILLIAM F. CLINGER, Jr.
ON HIGHWAY RESEARCH AND DEVELOPMENT PROGRAMS
STATE COLLEGE, PENNSYLVANIA
JUNE 20, 1988

Thank you, Mr. Chairman.

I too, take great delight in being here today with members of the Pennsylvania Transportation Institute to discuss highway research and development activities, and I take great pride as well to be able to represent the Pennsylvania State University before Congress. All Pennsylvanians are very proud of Penn State's academic achievements and its reputation as one of the this country's leading research institutions. And as a footnote, their pride in Penn State's academic achievements is only exceeded by their fervent support of the school's athletic program, and if you happen to have a free weekend this fall, I would be more than happy to escort you to a football game here in Happy Valley. The experience of sitting among 85,000 devoted fans is one that you will not soon forget.

The Pennsylvania Transportation Institute has a long history of involvement in transportation and highway programs. Their contributions over the years have led the way in the development of design criteria and construction techniques for our highways and bridges, and in the incorporation of features to improve the safety of our traveling public.

I'm sure everyone here recognizes that our economy cannot operate without a safe and adequate transportation network. The two are inextricably linked. When thinking about our future, though, I am bothered by the realization that we are no longer matching growth with new investment. We have witnessed a tremendous surge in utilization in all modes of transit, so much so that we are now straining the system and will soon begin to hinder future economic growth in certain communities. My fear is that while this may occur in isolated areas today, fifteen or twenty years from now many cities will be similarly plagued. This, to me, represents the biggest challenge for the immediate future and one that simply cannot be solved without adequate funding at all levels of government.

Concurrent with new investment, I believe we will rely more and more on Transportation Research centers such as the Pennsylvania Transportation Institute to meet future needs through ongoing work in materials research, traffic modeling, measurements, and other engineering disciplines, and through the training of transportation professionals.

I believe we must also work to achieve a more rapid pace of technology transfer and, to some degree, mitigate the risks associated with new technologies. It has been brought to my

attention on more than one occasion that local officials are very reluctant to use new and potentially cheaper alternatives because of the fear of exposing themselves to a host of unknown risks.

Despite this quandry, it has been well-proven in industry and government that one of the best investments that can be made is in research and development. Without it, the enterprise is doomed to failure as other forces overtake it and undermine its ability to accommodate new ideas, processes, and increased growth.

With that, Mr. Chairman, I'll conclude my remarks. Again, my thanks to you for taking a day out of your busy schedule to be here in State College, and my thanks also, to the staff of the Pennsylvania Transportation Institute for their presentations this morning and for their appearance this afternoon. We, in the Congress, are extremely thankful for the work you have done -- and are doing -- and I hope you won't hesitate to call on us whenever we can be of help.

-- E N D --

Mr. OBERSTAR. I brought with me just a sampling of the hearings conducted in earlier years by our subcommittee, many of which have become incorporated into college courses in civil engineering and highway design.

I bring them not to intimidate or as an indication of how much work is yet ahead of us, but this is the foundation on which we build. We will be pursuing many of the same subjects, not as detailed because that work has already been done; but it is an indication of the enormous responsibility—that together we have to maintain the quality of our highway and bridge facilities.

I would like to explain that this is the Subcommittee on Investigations and Oversight. We conduct hearings in a manner somewhat different from legislative subcommittees in that all testimony is sworn testimony.

That has been a tradition from the beginning of this subcommittee in 1959 and continues today. So, in a moment, when we call the panel to stand and take the oath, I do not want anybody to be surprised. It is just a part of the standard practice of this committee. No exceptions are made for any witness.

Our first panel consists of Dr. John Henry, Director of Pennsylvania Transportation Institute, accompanied by Dr. Evelyn Thomchick, Dr. John Mason, Dr. James Miller, Dr. James Wambold, and Dr. David Anderson who is back with us.

Would you please rise.

[Panel sworn.]

Mr. OBERSTAR. Dr. Henry, would you begin please.

TESTIMONY OF JOHN JEWETT HENRY, PH.D., PROFESSOR OF MECHANICAL ENGINEERING AND DIRECTOR OF THE PENNSYLVANIA TRANSPORTATION INSTITUTE, PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK; DAVID A. ANDERSON, PH.D., DIRECTOR, PAVEMENTS AND MATERIALS PROGRAM, PENNSYLVANIA TRANSPORTATION INSTITUTE, PENNSYLVANIA STATE UNIVERSITY, STATE COLLEGE, PA; EVELYN A. THOMCHICK, PH.D., DIRECTOR, TRANSPORTATION POLICY ANALYSIS PROGRAM, PENNSYLVANIA TRANSPORTATION INSTITUTE, PENNSYLVANIA STATE UNIVERSITY, STATE COLLEGE, PA; JOHN M. MASON, JR., PH.D., DIRECTOR, TRANSPORTATION OPERATIONS PROGRAM, PENNSYLVANIA TRANSPORTATION INSTITUTE, PENNSYLVANIA STATE UNIVERSITY, STATE COLLEGE, PA; JAMES H. MILLER, PH.D., DIRECTOR, PUBLIC TRANSPORTATION PROGRAM, PENNSYLVANIA TRANSPORTATION INSTITUTE, PENNSYLVANIA STATE UNIVERSITY, STATE COLLEGE, PA; JAMES C. WAMBOLD, PH.D., DIRECTOR, VEHICLE/SURFACE INTERACTION AND SAFETY PROGRAM, PENNSYLVANIA TRANSPORTATION INSTITUTE, PENNSYLVANIA STATE UNIVERSITY, STATE COLLEGE, PA; AND PROF. WOLFGANG MEYER, RETIRED

Dr. HENRY. Thank you, Mr. Chairman.

As director of the Pennsylvania Transportation Institute, I welcome the opportunity to testify with my colleagues who direct the research programs of the Institute.

I was very impressed this morning with the depth of understanding and the appreciation of the problems dealing with pavements

that were exhibited by the two Congressman during our visit to the test track.

The Pennsylvania Transportation Institute was founded in 1968 as an inter-disciplinary research institute of the Pennsylvania State University.

Currently, we have 45 faculty associates and 34 graduate assistants participating in research projects relating to transportation.

These researchers represent departments of civil engineering, mechanical engineering, electrical engineering, business logistics, statistics, psychology, and meteorology—just to give you an idea of the inter-disciplinarity of the Institute.

In addition, there are 15 support staff providing secretarial, financial, technician, and information services.

Currently, we have about $500 million—$5 million of—I have been listening to too many of your figures this morning. [Laughter.]

All right, about $5 million of research in progress at the Institute.

The Pennsylvania Transportation Institute, or PTI, has a national and international reputation for research. Earlier this month, the Institute hosted joint meetings of the American Society for Testing and Materials Committee on Pavement Management Technology and the Permanent International Association of Road Congresses Committee on Surface Characteristics.

After these meetings were completed, we hosted then the symposium, the First International Symposium on Surface Characteristics. PTI faculty associates are leaders in many national and international societies, and several have been active also with the United Nations involving Visiting Fellow Programs and missions abroad.

We value the opportunity to exchange ideas with experts in other countries, particularly the countries of Western Europe and Australia and Australasia-Asia.

The university transportation centers of the country contribute significantly to the solution of national transportation problems.

They provide a training ground for students working with faculty on research projects of interest to the state and federal agencies. These students will be the leaders in the transportation industry of the future.

The university transportation centers can provide unbiased solutions to specific transportation problems by assembling interdisciplinary teams to address them. PTI is a founding member of the Council of University Transportation which now consists of 36 member institutions. PTI leads a subset of these institutions, six of them, in a regional university transportation center consortium called the Mid-Atlantic Universities Transportation Consortium.

This Consortium has proposed to become a university transportation center under the new program funded by the Office of Secretary of U.S. DOT.

$5 million, as of now, is in place from the transit side for this program while an additional $5 million from the highway side is anticipated.

Congressman Shuster is working very hard to obtain this additional funding from the highway side, and we would certainly appreciate any help that you could give him in this matter.

This program, if it's fully funded, at the $10 million level, $10 million per year, will provide $1 million in Federal funds to each regional center in each of the ten Federal regions. The four-year matching fund program will provide support to universities for fundamental research. The total program value, because it is a matching program, will be at least $20 million. Two million dollars per regional center.

The Pennsylvania Transportation Institute has been very active in the Strategic Highway Research Program, the SHRP program, both during its planning stages and now as it's being executed.

The Institute is currently serving as prime contractor on two projects. It is a subcontractor on a third project.

The University Transportation Centers Program and the Strategic Highway Research Program are four and five year programs, respectively.

While they provide an outstanding opportunity for development, the university transportation centers must use this as a base to build a longer range program so that even when these programs have ended the centers will continue their mission to produce high quality research, disseminate the research, and train future professionals.

Thank you, Mr. Chairman.

Mr. OBERSTAR. Thank you. Next, we have Dr. Thomchick; or do you have a different order that you want?

Dr. HENRY. Yes, if we could. Dr. Anderson has to catch a plane.

Mr. OBERSTAR. Oh, he's got to catch a plane. All right. Fine.

Dr. HENRY. He was anticipating being second on the panel.

Mr. OBERSTAR. OK. Please go right ahead.

Dr. ANDERSON. I apologize for that, but I do have a plane to catch to Texas.

Mr. OBERSTAR. No problem.

Dr. ANDERSON. I am headed on to do some truck work, as a matter of fact.

I think I will not read the written testimony.

Mr. OBERSTAR. It will appear in full in the record and you may summarize it as you choose.

Dr. ANDERSON. I would like, if I may, touch on a few highlights.

First of all, I would like to reiterate what Dr. Henry said before with respect to the insight that you folks have on the pavement problems and the nitty gritty things. That was something pleasant for me to observe. I really appreciated that.

You folks are ahead of some of our graduate students, I think, in perception on some things. Although I shouldn't say that. That's a critical statement.

Mr. OBERSTAR. We'd better be ahead of them, or we're in trouble. [Laughter.]

Dr. ANDERSON. I think we all recognize the need to refurbish the infrastructure. Those terms, those words, those buzz words, we hear repeatedly; and we repeatedly we hear about the need for money to rehabilitate our infrastructure.

Very seldom do we hear people talk about the people that are going to carry out this rehabilitation. Congressman Clinger made a reference to this a moment ago; and that is very, very important.

To that extent, the universities will have to play a major role in this refurbishment of the infrastructure.

Much of this is going to come from the graduate program, not from the undergraduate program but from the graduate program.

Our graduate students are funded by the research monies, the research contracts, it is a fact that we bring into the university. It is simple to say no research contracts: no graduate students; no graduate students, nobody to do this rehabilitation or to conduct the work.

So, I plead that our nation's universities are going to become a key element in this refurbishment simply because they offer the opportunity to train the folks that are going to do the work.

Also, it is the place to learn and research the materials as well as the construction techniques that are going to be needed to do this refurbishment.

We cannot continue to do things the way we have always done them in the past. We must do them more cost-effectively, more quickly, and with more integrity to improve life cycle costs, et cetera.

I am directly affected by the SHRP program because I happen to be in the pavement area and be an asphalt specialist. I am happy to say that we do have part of this SHRP asphalt work here at the university and are going to be participating in that; and that is where, indeed, I have to go this afternoon, to catch the plane shortly.

What many of us in the profession are very much concerned about, however, is that the SHRP program may do us more harm than good simply because of the backlash that may come about from it.

We were talking earlier this morning with Jim Wambold who is talking about a ten year cycle.

The SHRP program is a five year program. If we do not have all the answers at the end of five years, what are you folks going to say? We should not have given you money in the first place, and do not ask for any more?

We cannot solve all the problems in five years. I will just give you one example. It is very difficult to build a pavement, a building, without stone: aggregate, as we call it in the profession. Increasingly, we do not have a place to get that material because they are building housing developments. The zoning people do not want us to take this material. So, there is a material shortage.

There is nothing in the SHRP program that studies the aggregates that are used in the construction process. This is a very, very important element; and I could go on and name other things that the SHRP program will not address.

It troubles me increasingly to see the technological advances or to see that the frontiers are not in the United States but instead in Europe, particularly in France and England.

People are looking there now for leadership in terms of new materials development, not to the United States. It is time to turn that tide, but with each passing year that tide gets to be stronger and stronger.

We hear about micro-chips. We hear about other high-level technology, but there are other technologies that are important as well.

I bring mine to the front. I know there are many, many other technologies; but we cannot become a second rate nation with respect to technological leadership. We must maintain ourselves in the forefront.

My only closing remark would be that I do hope that the SHRP program and the Council of University Centers or the University Centers Program is, indeed, the beginning of something new, something wonderful, from our perspective.

If that is the case, I am going to be very, very happy; but if it is a "one shot in the arm," we will do it and have all the world's problems solved, I am afraid. It concerns me very much if that is what the net result will be.

From the things I have heard you people say, I am sure that is not going to happen. Let's hope the message gets to others, as well.

Thank you very much.

Mr. OBERSTAR. Thank you. Dr. Anderson, what is your time frame? Do you have to leave fairly soon?

Dr. ANDERSON. I should leave in about 5 or 10 minutes, I suppose.

Mr. OBERSTAR. Let me ask you a question or two, and Mr. Clinger may have a comment, as well.

First of all, to express appreciation for the explanation and discussion that we had with you at the test facility earlier this day. It was very, very helpful.

I want to compliment you on the quality of research and the nature of the research being conducted.

You touched on something that really is of concern to me, and that is the five year nature of the SHRP program.

Typically, what time frames are involved in research conducted by other countries? Are you familiar with highway pavement research being done in Germany and France and Sweden and in Canada?

Dr. ANDERSON. In many of these countries, there are either long range governmental laboratories that are conducting research or there are research programs at universities that are more of a long range nature, although I might say that the institutes that are quasi-governmental organizations are perhaps the strongest research institutions in Europe.

I think of the, I am sorry I cannot pronounce the French, but the Institute for Roads and Bridges in France, for example, they are doing outstanding work. It is a, I believe, a quasi- governmental organization. I am not exactly sure or certain.

Mr. OBERSTAR. Do you know what length of time they have in their research programs?

Dr. ANDERSON. Do you mean from turn-around time?

Mr. OBERSTAR. Yes.

Dr. ANDERSON. From inception to application in the field?

Mr. OBERSTAR. Yes.

Dr. ANDERSON. I really, honestly, do not know. I should not testify in that regard.

Mr. OBERSTAR. When you do pavement surface and resurfacing studies as we witnessed today, what is typically the test period, the time frame, required from start to design of the project through testing, then evaluation? What time frames are you talking about?

Dr. ANDERSON. A cycle of research at the test track, for example, may require a year or two for development, for inception, to formulate the plans. Perhaps a year for construction, and maybe another two years for evaluation.

Then it will take several years beyond that before the technology will get transferred to the highway departments. If you add those numbers up, what do we have, six or seven years? Something of that sort. Five years? Five, six, seven?

It would depend upon the urgency of the problem; and, quite frankly, the highway departments do not always have the wherewithal to implement a lot of things.

Maybe I am sticking my foot in my mouth at this stage of the game, but simply because I think we need to be better trained. It is very difficult sometime to get people to adopt these new things, for two reasons.

One, often it is because people are afraid of new things in the highway business simply because they do not have the training; and, secondly, they are, after all, dealing with public monies. You hate to have a major faux pas out in front of the district offices. It is a difficult thing to explain. All the public sees that thing.

Mr. OBERSTAR. Clearly, the highway construction money dollars are limited, limited by what is available in the highway trust fund. Those dollars have to be wisely invested.

The highway department is leery of a new idea. Everybody has a great new idea. They come along and it can be an idea to make a fast buck, not to build a better roadway.

They understandably have to be wary, and that is why we want and need research programs to test out ideas, try the various alternatives, and prove them out on test sites like this so that the results of the research can be transferred to the state highway departments and be applied as local circumstances and finances dictate. That is the real value, it seems to me, of research and why we ought to have a longer term program than we presently have.

Dr. ANDERSON. Exactly. I agree.

Mr. OBERSTAR. One final question. What is your experience with the Transportation Research Board.

Dr. ANDERSON. The Transportation Research Board?

Mr. OBERSTAR. Yes.

Dr. ANDERSON. I am actively a member of Transportation Research Board. I participate in several committees and am active in activities of the TRB.

They form a very, very important role in this country. It is a place to synthesize, bring together information. It is a source of publishing data that would not otherwise get published. It brings people together that come from different backgrounds—I mean industry, as well as other research communities, as well as the highway community. It brings those folks together so they can communicate and exchange ideas.

It is a very, very important mechanism.

Mr. OBERSTAR. How do the activities of TRB differ from that of a university-sponsored research program?

Dr. ANDERSON. Okay. If you are referring to the National Cooperative Highway Research Project that is, in essence, run by TRB, as is the SHRP program, there are mainly disbursed funds.

We respond to their requests for proposal, and many of our research dollars do come from the NCHRP program and, now, of course, from the SHRP program.

So, we are recipients of dollars from these folks; but TRB performs more than one function. They are also a learned body, if you will; but they also are sponsors or distributors of monies that come from other sources, from national and whatever.

Mr. OBERSTAR. Thank you very much. Mr. Clinger.

Mr. CLINGER. Thank you, Dr. Anderson. I know you are under very strict time constraints here; but I do want to thank you very much for your testimony and, also, for your very enlightening presentation this morning.

Just one question. You are involved with the SHRP program.

Have there been any interim results with regard to prolonging the life of paving materials, for example, as a result of the SHRP program; and, if so, are we implementing those recommendations or findings anywhere?

Dr. ANDERSON. No, sir. It is too early yet. The program is just getting off its feet.

The first project, in the asphalt area, for example, the first contract, the management contract, has been in force since last October. The first research contract has only been in force since May 16th, just very, very recently.

I am going to a planning meeting, working on the research plans, work plans, or whatever. So, it is very, very much in its infancy right now.

Mr. CLINGER. Can you give us any idea of the time line when you might begin to anticipate having some results?

Dr. ANDERSON. It is going to depend very much—I am not trying to be evasive here—but it is going to depend very, very much on the particular area that is being studied.

The fundamental asphalt research that I am involved in may take a while. That may take five years. Some of the maintenance work that is being done, that may be much shorter.

So, I would not expect to see really significant impacts before the five—about the time the program is ready—as it winds down there will be things that can be done or implemented.

Mr. CLINGER. Which may also give us some indication of why we should continue the program.

Dr. ANDERSON. I hope that is true.

Mr. CLINGER. Well, thank you very much and have a good trip.

Dr. ANDERSON. Thank you. It has been my pleasure.

Mr. OBERSTAR. Dr. Anderson, we will not keep you further. You are excused.

Again, thank you for the tour of the test track this morning and for your very knowledgeable and informative presentation. We wish you continued success in your very important endeavors.

Dr. ANDERSON. Thank you.

Mr. OBERSTAR. Now, Dr. Thomchick.

Dr. THOMCHICK. I would like to discuss the Transportation Policy Analysis Program at the Institute.

Transportation policy analysis has been an important area of research at the Institute since the Institute was established in 1968.

Research studies in the Transportation Policy Analysis Program focus not only on the condition of transportation facilities but also on broader-based issues that affect the planing and operation of transportation systems.

Research in this program is inter-disciplinary and, over the years, has produced a mixture of financial, economic, legal, engineering, and management studies.

I would like to discuss one very important and unique part of the policy analysis program and that is the research that is conducted for the Pennsylvania State Transportation Advisory Committee.

This committee consists of 30 members including: the State Secretary of Transportation, heads or designates from six other state agencies, legislators, and 18 public members appointed by the Governor and by the heads of both legislative bodies.

The functions of the committee are to undertake in-depth studies on key transportation issues, consult with and advise the Secretary of Transportation in the Transportation Commission, and serve as liaison between the Department of Transportation and the public.

The Institute's policy analysis program serves the committee in all three areas by providing research to conduct the committee's studies, although personnel from other areas of the Institute may participate depending on the topic, assisting the committee in developing recommendations to be submitted to the Secretary of Transportation, and publishing reports on the studies.

As I mentioned, studies conducted for the advisory committee encompass a broad range of policy issues, but one topic that has been examined frequently is that of transportation financing. The importance of transportation financing, I think, is reflected in some of the current projects that we have underway for the advisory committee.

In one project, PTI is developing a microcomputer-based highway cost allocation study model for Pennsylvania. This model will producer user-equity ratios that reflect user cost and revenue contributions for Pennsylvania's highways.

A second finance related project that is being worked on jointly by personnel from the policy analysis program and also by the Transportation Operations Program at the Institute is one in which various approaches to transportation financing, in particular public/private partnerships, are being investigated for application to traffic congestion problems. Dr. John Mason is working jointly with us on that project.

Other recent projects in the policy analysis program reflect major national transportation concerns. Two recently completed studies dealt with the motor carrier industry.

One study focused on motor carrier safety, in particular the effectiveness of roadside inspections; the other examined the administration of motor carrier activities by state transportation agencies.

We have also conducted studies on other modes of transportation such as aviation, the state role in aviation, and the state's role in rail-freight line preservation.

The association of the Transportation Institute and the State Transportation Advisory Committee provides many benefits to both parties.

The Advisory Committee, and thus the Department of Transportation, obtains research expertise in a variety of areas at an economical cost.

On the part of the Institute, there are many academic benefits for both the faculty and students involved, certainly in the form of publications and student projects; but, most importantly, in the exposure of faculty and students to current realistic policy problems and the opportunity to make positive contributions to an active government organization.

It is very rewarding that the department has been very receptive to our studies and has acted upon many of the recommendations that we have made to the department.

The research of the advisory committee also provides the potential for expanding the projects undertaken for the state into projects at the national and international level.

Unfortunately, decreased funding opportunities in transportation policy analysis have made these efforts more difficult than in the past.

Two examples of funding opportunities that no longer exist are the U.S. Department of Transportation University Research Program and the Maritime Administration University Research Program.

The Maritime Program had relevance to the policy analysis program because we have also initiated some research in the area of international transportation and logistics.

It is disheartening that transportation policy research appears to be de-emphasized at a time when the increasing transportation needs and decreasing funding sources make effective management of transportation projects, resources, and agencies more important than ever before.

That concludes my comments.

Mr. CLINGER. Thank you.

Mr. OBERSTAR. Thank you very much, Dr. Thomchick. We will continue with Dr. Mason.

Dr. MASON. I appreciate the opportunity to address both of you this afternoon.

I think, in a similar vein as Dr. Anderson, I may want to make some additional points and leave the written comments set for the record as they are.

There are three specific areas that I thought I would try to spend my few minutes with you, and those were listed in the prepared statement.

The emphasis on integrating research findings into design policies, if you want to put that in parentheses, that deals with timeliness. So, I will address that in a few moments.

From an economic, viewpoint and to try to salvage our existing pavement structure, the feasibility of exclusive truck facilities would be the theme of the second comment.

Finally, trying to address, from a perspective of ensuring an adequate supply of transportation professionals, not only an adequate supply but a qualified supply.

One thing that happens in the business world, when jobs become plentiful in a certain area, then everyone will flock to those. Then, the quality of the education, the quality of the research, and the

quality of the people performing those services, tends to taper off because a lot of those, people call them "fat cats"—are a lot of people running around trying to get a piece of the action.

We want to ensure, as the infrastructure becomes rehabilitated through reconstruction efforts, that we do not fall prey to "fat cats" with quick remedies, only to be here today and gone tomorrow.

So, with those three issues in mind, let me try to add to my written comments.

The integration of the research findings into design policy: my area happens to be in the design of the highway facility, the geometrics, the cross-section, what the driver sees as he drives down the roadway, and try to maintain that in a safe and organized manner.

There was a time when those policies were actually written and prepared by the Federal Highway Administration and then adopted by the American Association of State Highway Officials.

Most recently, in the 1984 "green book" or policy book, a new model was set in motion where the AASHTO actually prepares the documents on a voluntary committee basis and then the Federal Highway Administration will review those and try to integrate any more current research efforts.

The unfortunate element that I see in that evolution is the fact that it is done on somewhat a voluntary basis. Granted, staff and people are released from their normal duties to participate in that activity; but to say they have the adequate time, background, and experience to integrate all the research efforts that are going on, I would say that is where some difficulty lies.

Let me make reference to an example that is not in the written statement.

A few years ago another operational manual, called the "Highway Capacity Manual," was assembled through the Transportation Research Board as Special Report 209. 209 is an example of where the research community, industry, and the highway agencies all came together to put together a document that can be updated in a timely fashion. I refer to it as the "three-ring notebook" approach.

Rather than waiting every 10 to 15 years to put out a hardbound copy of policies and guidelines, this three-ring notebook would allow for the timely insertion and review of new operational criteria.

I would state and advocate that such research on how that should be done for design policies ought to be goal of the Federal Highway Administration.

With all the research dollars that have been spent, will be spent, and will need to be spent, I would think some methodology should be developed such that all the facets can have their input. In essence, then we will have the timeliness of our research findings, by putting out good design guides.

Those design guides, by the way, I feel should be sensitive to tort liability issues.

I have acted with several states throughout the United States, some in the Southwest and some in the Northeast, in trying to resolve some of their tort litigation problems as an expert witness,

only to find occasionally some suits that are frivolous and others that are not frivolous.

Nonetheless, when policies are written without the tort litigation perspective in mind, they can often use up some of our valuable resources in paying judgments or settlements that may not be noteworthy or may not be true.

So, I am saying, from that perspective, we need to integrate research findings in a timely method; and I hope that the design policies can incorporate some of the features of the Highway Capacity Manual.

Let me move on to the second specific point that I wanted to make, and that dealt with the feasibility of exclusive truck facilities.

I spent approximately 7 years with the Texas Transportation Institute and had directed some projects dealing with the potential or feasibility of segregating truck traffic from the main lines on Interstate 35, from the Dallas-Ft. Worth area to the San Antonio region.

The impetus for that work was the situation that if we took the trucks off the two lanes on the interstate, we should be able to salvage the pavement life and not have to put in extra dollars to resurface it in such a short period of time, and we could accommodate the trucks through a separate lane in the median or on the shoulder, such that the pavement would be designed to carry the loads that would be anticipated.

The features would be segregated so that you would not have the small cars competing for space, and safety problems with the large trucks. Many of the large trucks do travel long distances on the interstate and do not get on at one interchange and off at another, as many commuters in the urban area.

I have listed in the prepared statement several potential examples that appear feasible.

Well, notwithstanding, what is the area of research that I would like to advocate, I think the safety and cost-effectiveness of trying to segregate them is what needs to be done.

I am not suggesting that we build a complete system of highways for trucks only; but there are certain corridors where, perhaps, as we rehabilitate, as we look at our new investment in the future, this is the opportunity, perhaps, to segregate the vehicles in different lanes. We have some of that in the New Jersey corridor; I think it is one of their toll facilities now; but throughout the United States you will see that that is done on a very few occasions.

Therefore, we have to perform pavement rehabilitation, deal with special roadside safety issues, where we are trying to accommodate two vehicles: a passenger vehicle and a truck. They have different operating characteristics; and one, the automobile, not very crash-worthy when it comes up against an 80,000 pound truck.

So, there may be several opportunities here to make a wiser investment in salvaging that which exists on the system and then accommodating both types of vehicles in their own segregated environment.

My last comment, and probably one that is very important to me in my short tenure of about 16 years beyond my undergraduate work, half of which was in the private sector with the design of fa-

cilities, representing consulting engineers, and then coming back to do research and teaching: one of the reasons for coming back was the fact that I realized that some of the transportation professionals that are out there, in both the public and the private sector, do not have the tools. They do not have the time. They do not have the knowledge or the education to implement some of our research findings. You have heard that, and I think you will continue to hear that from other people on this panel.

One of the recommendations that I see as being very important is that there has been a move afoot that the local agencies, local state highway agencies, try to do some of that training on their own: let's get it back to grassroots.

While doing that sounds like it would be closer to home, it ends up duplicating a lot of existing of training programs.

I have been fortunate to travel the United States and give lectures in different states. When I ask for the materials that are available, I am surprised that what they are doing in X-state, state-B has just put together similar short course. $50,000 may have been spent to put together a short course in one area; that had someone told them about what existed somewhere else, we would not have had to duplicate that effort or spend that money.

So, in the benefit of local needs to address local problems, we end up duplicating some efforts unnecessarily.

So, the work plan that I outlined in my little statement here says that there are some common goals that any transportation agency needs to have for providing continuing education of their transportation professionals.

If a federal study could be initiated that identifies the core of those transportation needs for training future professionals, that could lay the groundwork such that duplication of effort in training these people does not continue.

Let me touch on another issue of why we need to constantly train our transportation professionals.

It is not unusual, in civil engineering programs throughout the United States, that a student can graduate with a bachelor's degree in civil engineering and have only one transportation course in their undergraduate curriculum. That course, 3 credits, would cover the planning, design, operation, maintenance and construction of a highway facility—one 3 credit course—because they are being asked to put in all types of necessary courses in a four-year degree.

So, that means someone leaves our institutions, with an undergraduate degree in civil engineering, that will be working on our infrastructure problems, with only one course in transportation.

That means they have to get it through continuing education or through future graduate study. That is the fact.

That is why I think there needs to be a re-thinking, and new energy to look at, how, from a cost-effective point of view, can we maintain some continuing education for our practicing professionals.

I would like to conclude with one example of how the Commonwealth of Pennsylvania is planning to pursue that activity. I have been asked to put together a pilot course for the Pennsylvania Department of Transportation. We will use the satellite facility to

transmit a short course to the various district offices, which we will conduct here at Penn State, a five-weeks, 2-hours per day, short course on new geometric design principles.

I will be inviting people from the Texas A&M University to be some of the lecturers in hopes that we can develop a relationship between the Texas A&M University and Penn State, that they may be able to beam up to the satellite a short course one day that people in Penn DOT can be sitting their offices, from 4:30 to 5:30—take notice that is splitting the work day with a little bit of extra time—and get benefit out of some of the programs that the Texas Highway Department has put on for their transportation professionals.

So, in conclusion, I tried to hit on three issues, each of which I have some specific background and experience in; but, nonetheless, you can see that the continuing education of the transportation professionals is probably the one dearest to me right now.

So, thank you for the time and opportunity. If you have any questions, I would be happy to address them later.

Mr. OBERSTAR. Thank you very much, Dr. Mason. You have presented some interesting insights here that we will want to come back to in a moment to inquire about.

Dr. James Miller.

Dr. MILLER. Thank you very much. I am the Director of the Public Transportation Program at the Transportation Institute.

It is a little bit different than some of the other research areas, although the theme of my remarks, really, is very much the same in terms of the priorities.

I also might say I am chairman of the local transit authority, and that I appreciate Congressman Clinger's interest in local transit services. I remember, in contrast to this day—Congressman Clinger's visit on a cold, snowy Groundhog's Day several years ago—and he expressed the same knowledge of transit as Dave Anderson had indicated you demonstrated concerning the highway system.

So, I know that you are aware of the needs in the public transit area, as well.

I have also been designated to be the director of the Mid-Atlantic Universities Transportation Consortium, the Region 3 entry into the University Transportation Centers program. We have put together and submitted a proposal for six universities: two in Pennsylvania, two in Virginia, one in Maryland, and one in West Virginia, to be a part of that four-year program.

Some of the research that will be conducted if we are awarded that grant includes some of the things you saw this morning, the computer, the graphics, and that type of thing, as well as supplying high-tech state of the art information systems to public transportation, as well as inter-modal freight movements using satellite location systems.

The two issues I would like to talk about today in the public transportation area are the need for a continuing research program, and then I want to reiterate the theme that others have mentioned—the need for training.

I chose those two topics based on an experience I had several weeks ago. TRB and AASHTO sponsored a conference on the state

role in public transportation. It was a workshop to discuss what the state's role should be.

I was very pleased with the tone of the conference. Unlike others that I have attended during the last few years where participants complained constantly about what the federal government is not doing, and concluding that the answer was more money, the state's role conference participants accepted the state's increased role in transit finance.

After all, the states and local governments are putting more money into transit now than the federal government. The attendees who were mostly the state DOT people running transit, as well as the operators, are willing to accept that role.

But two recommendations came out of that meeting that are directly related to what we do here at Penn State and I would like to offer them to you today. The first is the need for an ongoing research program.

Certainly, the University Transportation Centers program offers possibilities in that respect. $5 million a year will come from the one-penny of the transit fund to pay for part of the research, and a lot of the research will be involved with public transportation topics.

Another program that has been proposed to respond to a declining amount of effort being spent on transit is the Strategic Research Program for Transit, (the STRS Transit). The Transportation Research Board published a report last year that summarizes the recommendations of this group (TRB Special Report 213, 1987).

What this industry-wide group proposes is that half a percent of the existing Section 9 and Section 18 transit funds that come from the one-penny, the gasoline tax, be devoted to transit research of a very applied nature that the transit systems can use.

Of course, for the last number of years the general federal philosophy has been that transit is a state and local responsibility. We can debate that.

However, even as states and local governments have increased their role, the general conclusion of many is that the federal government's role certainly would be in the area of research because that applies to all.

Research topics have been suggested to PennDOT but when they have said that: well, that's a very interesting problem but it is not just Pennsylvania's problem. Why isn't there a national research study of that area?

So, no matter how you feel about the federal role in the funding of transit, I think there is a federal role in sponsoring research.

One of the projects that we have been involved in for the last two years is the development of the plans for a bus testing facility in Altoona.

As we worked on that, it became very apparent that we really need to know a lot more about the kinds of tests that would be appropriate and how could we ensure that the federal money being spent on new buses is spent wisely.

A lot of applied research needs to be done to implement that part of the Surface Transportation Act.

So, there is a need for ongoing research. The transit community has proposed to use existing funds for this purpose. The research

agenda would be dictated by a combination of researchers as well as transit industry personnel.

The other item that came up at the state's role meeting was training. A number of the state DOT directors stood up and said: the state's are willing to accept their increasing responsibility but we cannot find good people to work for us.

Now, part of that may be low salary in some cases; but a lot of it, they said, was that they just do not have the pool of talent coming out of the universities that they did ten years ago.

So, to the extent that federal training programs, education programs, and research programs can focus on this need and emphasize the need for internships and graduate assistantships, I would like to recommend that to you. Public transportation has a role to play even in the primary focus here in the highway area.

We were talking at lunch about the suburban gridlock problems. Public transportation in the broader sense, including van pooling and other more creative approaches than running subways and trolleys, has an important part to play.

I would stress the need for the research and the good people that understand both the highway side as well as the transit to implement these plans.

Mr. OBERSTAR. I thank you very much, Dr. Miller. We appreciate your perspective on those issues, particularly that of attracting qualified people into this area and keeping them. We will come back to that in a moment.

Dr. Wambold.

Mr. WAMBOLD. Thank you.

I appreciate the opportunity to be able to bring to you several matters. I, too, support the educational aspects that have been brought up; but I think that they have been covered well and, therefore, I am bringing up two other issues that I would like to discuss.

The first concerns test facilities at the Institute and, particularly, the test track that we talked about this morning, with possible expansions that could be made available to the government.

The second topic involves the commuter airline industry.

I serve as the Director of the Vehicle/Surface Interaction and Safety Program which was started even earlier than the Institute, under the leadership of Professor Meyer. Later it was taken over by Professor Henry and, now, myself.

I believe one of our outstanding facilities is the test track that we visited this morning. It presently has a number of capabilities that we showed you; but, in addition, this summer we are going to be starting a program of crash testing of plastic barriers and, later, of bridge rails.

With that in mind, there are two additional possibilities for our facility. One relates to the first article of bus testing that Dr. Miller just discussed and that of vehicle testing.

We have discussed with the Urban Mass Transportation Administration the addition of a lane to allow the testing of first article bus testing as field testing to go in conjunction with the facility down in Altoona.

We have also discussed with the National Highway Traffic Safety Administration possible conflicts of interest that might arise

where they are testing at the Ohio test track in East Liberty which used to belong to the State of Ohio and has now been purchased by the Honda Corporation.

We believe that if the resources from UMTA that are presently committed under the highway bill were made available, along with resources from the university, from the Pennsylvania Department of Transportation and, possibly, NHTSA, that a much better facility could be made for the first article bus testing.

Under the present bill, most of the first article bus testing that needs to be done can be accommodated; but there are a couple of key issues that cannot be taken care of because of the limitation of the money that is there now.

Equally, then, we could accommodate the type of testing that NHTSA is presently doing at the East Liberty facility. So, then with less than half the money that is going to be put into the track or looking at the track with UMTA right now, we could accommodate all these facilities.

I, therefore, would propose that the expansion of the Pennsylvania State University test track to accommodate both UMTA's first article bus testing and NHTSA's requirement and FHWA crash testing program would be a cost-effective method of expansion and use of government funds.

The second topic that I would like to bring up is the commuter airline industry. As I mentioned this morning, I am a pilot and generally do my own flying; but for the last six months I have not been doing that and have been using the commercial airlines. To get in and out of State College you fly a commuter airline.

Now, many small towns are served by only one airline, mainly a commuter airline. Therefore, if their service is not satisfactory or you are not happy with them, your option is to drive to Pittsburgh rather than fly the airline.

So, there is not the competition there that is there at a major airport.

I find that the commuter airlines frequently cancel flights, are late, and their explanation is always that there is maintenance problems.

I recently flew down to Hampton, Virginia for a meeting. I arrived at the airport and found that the flight was cancelled. It turned out there were five of us scheduled for the flight. They rerouted us through Pittsburgh and back to State College. So, instead of getting back at 9:00 we got back at midnight.

I know that quite frequently, in fact, normally, the flight from Philadelphia to State College on a holiday is cancelled. Even though it is listed in the schedule, it never flies.

I would like to suggest that consideration be given to some regulating of this part of the airlines' operations. Particularly, I would like to see that they are surveyed with respect to delays and cancellations by the FAA, as are the major airlines right now.

Because without competition and in the absence of government regulation, the public is not being well-served in this area.

Thank you.

Mr. OBERSTAR. Well, you strike a responsive note. If I had a nickel for every hour I spent in an airport waiting for one of those

to take off or bring new equipment in, I would have a small fortune. [Laughter.]

You will be somewhat relieved. This subcommittee is going to conduct a major inquiry into commuter airline activities, particularly the way they conduct maintenance and the relationship between their overall operations and their maintenance capabilites. We know that there are some problems in the commuter airline industry. We are going to be looking into that very carefully.

The SHRP program is a five-year program. I think each of you have said in one way or another that it needs to be a longer-term initiative.

First of all, do other countries have permanent, nationally supported research initiatives, or do others have short-term initiatives like the SHRP program?

Dr. Henry, are you familiar with that?

Dr. HENRY. There is nothing quite like the SHRP program in terms of a major commitment of funds over a short period of time, to my knowledge, in the other countries.

The other countries, however, do have a continuing long-term, nationally funded program—most of them do. These are through their government-sponsored research laboratories operating largely in conjunction with the academics of their country.

Mr. OBERSTAR. Well, was it Dr. Anderson who suggested that the United States has lost its technological lead to Western Europe?

Professor Meyer, perhaps you could—and I would like to welcome you to the hearing at this point.

Mr. MEYER. I guess I am not sworn in yet.

Mr. OBERSTAR. We will waive that at this point in the hearing. You were a witness so long ago in these hearings that we need not be concerned with that detail.

Mr. MEYER. Thank you.

Mr. OBERSTAR. Is this a matter of concern to you—could you expand on that concept: In what areas has the United States, in your opinion, lost its technological lead?

Mr. MEYER. Well, there are a number of areas and one of them is high-speed rail.

We have in this state a high-speed rail commission that studies the feasibility for a rail link between Philadelphia and Pittsburgh.

The only technologies available that they can consider are foreign ones.

One of the reasons that this is so is probably that it is being done on a state-by-state basis: Ohio, supposedly, has a similar commission; California has one; various other states, presumably, too.

This is, perhaps, where the federal government should be reaching in and coordinating these undertakings, thereby making it attractive to private industry to come forward with technological solutions to the problem, so that we do not have to borrow them from somebody else.

Mr. OBERSTAR. Well, I think we might have a real problem with that because, as Mr. Clinger can tell you, from a previous hearing we had on the Buy-America aspect of our Federal Highway Administration and Urban Mass Transportation Administration programs, we learned that virtually all the engineering, design, construction, manufacturing processes moved off shore.

We do not have the capacity to manufacture heavy or light rail units in this country. That work is being done in Italy, in Japan, in France, in Germany.

The new technology is not being provided in the United States. It is being done elsewhere.

Mr. MEYER. Well, because the market is limited. How many streetcars are being bought or even considered in the United States? So, obviously, it would not be of any advantage to any manufacturer to maintain a streetcar manufacturing facility.

Mr. OBERSTAR. Yes, but at the same time it is very shortsighted on the part of transportation policy planners, which is Dr. Thomchick's specialty area, when in urban areas of the United States our need is to move people. In rural areas of the United States, the need is to move vehicles.

We have to get 7 million people a day, into and out of New York City. The vehicle is not going to do it. The car is not sufficient. We need mass transit facilities.

If we are going to allow the new ideas and new technology in that field to be initiated in Europe or in Japan, we are going to fall farther behind.

I am interested, particularly, in road surface technology. Do you feel that other countries are moving ahead of the United States in this area?

Mr. MEYER. Yes, I think so, particularly in the matter of implementation of existing knowledge.

We depend on a variety of—first of all, the fifty states are pretty much independent on the solutions that they employ: in addition, there are innumerable county and municipal maintenance and construction agencies.

The personnel in this variety of organizations is simply not up to the task of employing all the presently available technologies in a cost-effective manner.

True, they are limited by limited funds; but so is, I guess, everybody else in the world.

Mr. OBERSTAR. Well, true. Our federal structure, with a national government and state governments, necessarily results in a fragmented approach.

Mr. MEYER. Yes.

Mr. OBERSTAR. Ninety percent of the interstate funds is federal. Ninety-nine percent of the construction, design, and right of way acquisition, and operation is state and local.

We have a problem that maybe other countries do not have; but, Dr. Henry, you talked earlier today about the time lag between idea and implementation of technology transfer.

What problems do you see and how can we shorten that time frame?

Dr. HENRY. Well, we have to get the word out. The best way to do that, from our viewpoint, is by publication through the Transportation Research Board forum and also through the American Society for Testing and Materials where a lot of the states are well-represented—not all the states: in our Surface Characteristics Committee, about half of the states are reasonably well-represented.

The matter is one of technology transfer to these agencies. The state agencies are about as far as we can reach through those vehicles.

Getting down to the municipal and the local governments is being addressed through the Rural Technical Assistance Program, the RTAP program, spearheaded by FHWA. We are active participants in that.

These things tend to reduce the lead time to implementation.

Mr. OBERSTAR. What coordination is there between research initiatives in transportation at an institution such as yours and those of other academic centers, those of the various states, and with the federal government?

Dr. HENRY. Pardon? Excuse me. Would you rephrase the question?

Mr. OBERSTAR. What are the coordination mechanisms, and are they sufficient, to share information from research centers such as yours and others throughout the country, as well as with the states, and the federal government institutions?

Dr. HENRY. Yes. Well, the federal research is coordinated in a coordinated program, the FCP program of the Federal Highway Administration. Also, the National Cooperative Highway Research Program is a coordinated research program.

These two interact to try to minimize duplication of effort.

The dissemination of the information, though, goes out to the states through the vehicles that I mentioned previously: through the forums that we have.

Mr. OBERSTAR. Is that sufficient? Is this an adequate means of sharing information? Getting it from your test site and from your research reports to the users? If not, how can that technology transfer be speeded up?

Dr. HENRY. I've got a note here I don't understand—

Dr. MASON. NHI.

Dr. HENRY. Oh, the National—

Dr. MASON. National Highway Institute.

Dr. HENRY. Yes, the National Highway Institute. You may want to address that, John.

Mr. OBERSTAR. Please.

Dr. MASON. Yes, perhaps I can.

If we look back just a decade ago, ten years ago when we were looking at roadside safety hardware, the National Highway Institute, part of FHWA, did, using federal dollars, support programs where individuals went to the various states, to those state highway departments, with the primary goal of disseminating research results.

I can remember that I was part of the team traveling to several states with a five-day course on how to put up the proper longitudinal barrier, or guard rail, guide rail—whatever the state has adopted today.

In the interest of bringing things back to the grassroots again, NHI does offer some of those programs; but the state departments of transportation will have to pay to recover the costs incurred in putting on these courses.

When you look down a long list of budget of what has to be spent to re-surface, to rehabilitate, and you get to the point: do we buy 10

courses from NHI to transfer research information or do we try to do it in-house and get more paint on the road or more surface on the road? You can see the dilemma that an administrator has to face.

So, I have been a proponent, that I think there needs to be a base line of continuous NHI support. When there are critical research findings, critical implementation-type issues, that the states should not be penalized by having to pay to have that information brought to them.

That ought to be brought to them as part of the research program. Since FHWA funds the research, a portion of that research program should have dollars set aside for immediate implementation.

It does not have to be a large magnitude of dollars, but just to get that first set of information out to state level.

So, I do think that NHI, the National Highway Institute, had been doing an excellent job in providing that service; but, as all things go, certain budgets need to be re-evaluated and perhaps they could no longer provide that service.

It made the states actually pay to receive that information that you are suggesting should be disseminated. Once you have to pay for something, you have to think twice about whether you want to do that or not.

Mr. OBERSTAR. How receptive are states to new ideas, concepts that are developed like, let's say, the truck escape ramp that we viewed this morning?

How long does it typically take for a state to assimilate the information you have developed and implement it, put it into practice?

Dr. HENRY. Well, I think that is relatively quick in the case of that particular project.

That was sponsored by PennDOT to address a specific problem. The results were very good. It showed that the beds could be constructed at a considerably reduced cost.

The word has got around. We now are preparing a proposal for some research for Arizona. Even if our proposal is not the successful one, I am sure it will draw heavily upon our research findings in Pennsylvania.

So, I think that is a case where the payback and the payoffs are so obvious that the states will adopt it.

Some of the other things are more subtle, such as the relationship between skid resistance and pavement texture, and how that should be monitored and measured. Some of the historical procedures have been shown to be deficient and that there are other methods available today.

That varies quite a bit from state to state. Some of those states that have good research programs and participate in the national organizations tend to be the leaders in implementation of that research. To mention a few, Florida, Virginia, have been very good. Arizona, and so on, have been quick to pick up some of those things.

Mr. OBERSTAR. I know in education it was an axiom that it would take fifty years for a new idea to become accepted into the field. I think that time frame has been shortened in recent years. I made a note, Dr. Mason, as you were speaking about dissemination of in-

formation and making it available to the users, in the age of computers, in the age of electronic transfer of data, finances, mail, we ought not to be inhibited in getting information from State College, Pennsylvania to the highway department in Arizona or California or to northern Minnesota. We ought not to be limited when we have satellite hook ups for transmission of information.

I can give two examples. Some years ago, this subcommittee was concerned about overlapping research being conducted by the predecessor to EPA. We found that EPA, then the Federal Water Pollution Control Administration, was approving research grants for products that had already been developed in contracts previously submitted, studied, evaluated and put on a shelf in the FWPC library, never again to surface.

As a result of our inquiry, EPA changed the way they conducted research. They now have a central, computerized library, where before any project or research proposal is even considered, it is run through the computer from different aspects. They determine whether that issue has already been done and, if so, what aspect of it.

Dollars are saved by avoiding the duplication of previous research.

Secondly, the Mayo Clinic of Rochester, Minnesota has established two satellite clinics: one in Florida and one in Arizona.

In their Florida operation, they have a daily satellite hook up with the heads of all the departments at Mayo Rochester. Each day the physicians in the Florida and Arizona clinics sit around a table to confer with their colleagues in Rochester—through discussions, slides and communications—as though they were sitting in the same room.

Well, they solve problems. They go back into their hospital room or into the operating room and have the benefit of this huge research center and clinic in Rochester at their fingertips on a daily basis.

Maybe you don't need to have information transmitted so quickly in highway, bridges, and mass transit; but the capability is there and it ought to be used.

It is shocking to me that it is taking 10 years to get ideas from your facility into practice on the roadways.

Now, we are just going to have to shake some people up.

We have the practice on this committee of moving back and forth on the questioning. I will yield at this point to Mr. Clinger.

Mr. CLINGER. Thank you very much, Mr. Chairman. I want to convey my appreciation to the entire panel for what I think has been very, very stimulating and very interesting testimony.

They have raised a number of important issues that directly relate to the work of the subcommittee and the sorts of things that we are involved in.

Just following up on the Chairman's line of questioning, Dr. Mason, you know we have 20 or more transportation, basic transportation, research institutions or groups around the country to what extent do you think we are re-inventing the wheel?

What kind of efforts are being made along the lines that you talk about in terms of trying to coordinate so that we are not, wasting money by duplicating research from one institution to institution?

Dr. MASON. I think a solution has come about somewhat by default.

There has been a drying up of—we call it the "Ph.D. pipeline" in transportation. In the last 10 or 15 years, there are very few people that have pursued transportation research activities.

During that time period, the research institutes have had to share information and personnel. It is not unusual to see people in one institute for a certain number of years, then a position opens up and they move somewhere else.

So, I say by default a lot of this information now has come about because we all know our colleagues in the other institutes. We all meet at TRB.

From a research point of view, I will say that we usually are working together on contracts, subcontracts. That environment of sharing the technological information, we can assure you, is happening at all the associations we all belong to.

The element that I see as the missing link is while the researchers, academics, know what is going on, getting it down to the grassroots through all this great technology is where we find some difficulty.

There is a new breed of trained professional: young, enthusiastic; give him a microcomputer they will hack their way at it and they can communicate to anybody in the United States. That is the new breed, and that is where we are going.

Unfortunately, sometimes to get this hardware—which I will put this in parentheses: it is usually the hardest thing to get on research contracts. We need this equipment: the computers, the satellite hook up and whatnot. Trying to find a way in our research contracts to support that hardware is usually very difficult, so we have to come up with very innovative approaches.

Typically, state departments will receive seed dollars to implement a training program, or to implement some technology, or to implement research.

At the University of Florida, where they had the microcomputer transportation center to disseminate all this information, we know that there was money available to get them on their feet and keep it going.

Then, within a few years—I do not know if it was two or five—they had to become a self-sustaining, transportation resource center for microcomputer information.

Where do you think the problem lies? As soon as we pull away the baseline support, ask them to stand on their own feet, some of them are successful—and if they are, that is because they had to cut some things in order maintain it. I understand that the program is sustaining itself. Some of the cost to purchase that microcomputer software or literature access is getting a little higher now.

So, maybe the law of supply and demand will come in effect there somewhere; but my point is, as in any R&D program, there must be long term assurance that baseline support is going to be carried on.

It does not have to continue to rise; but once you get something implemented, a system of transferring technology, to say that we are only going to give you the money for a few years, then you

have to come up with an innovative approach to financing it internally, I think that is what causes the most pain at state levels. Then at the local level, it is traditionally the first thing to go.

Once you ask them to take it out of their local operating budget, they will see that as being something: well, we'll wait for the next federal shot to come along.

I would rather see a maintained minimal level that we could all bank on than "hey, give you a shot today and maybe a couple of years from now we'll give you another shot."

So, that is my comment to that.

Mr. CLINGER. Perhaps this question should go to the entire panel because you all alluded to it in one way or another, and that is the lack of graduate students. The fact that you are not getting the people into the pipeline who are going to be needed in the short term and, certainly, in the long term.

To what do you attribute this?

Is it because of the stop and go funding? Or is it a combination of reasons? Why do you think that the field has not been as attractive recently to graduate students as it was in the past?

Dr. HENRY. I think some of this is the PR. There are so many high tech areas and fields that are competing, particularly for the engineering students, that have so much more appeal to the young student that they look upon the transportation industry as not glamorous enough.

I think this is a misconception and often it turns around. By the time they get into graduate school, students find the opportunities that are in the transportation industry.

We do attract some, but by then we have lost a lot of the better ones to such things as the aerospace and computer science fields.

This is something that the American Road and Transportation Builders Association—we had a gentleman here from ARTBA today—has been addressing. We have been working with ARTBA to try to help get some information out through the education division of ARTBA to try to attract better students at an earlier stage in their career into the transportation industry.

There was a brochure prepared. Now, there is some activity going towards developing a video tape, directed at high school and entering university or college age students.

Mr. CLINGER. Is there anything that we could do at the federal level to facilitate?

Dr. HENRY. Well, yes, I think so. ARTBA is really putting that together on a shoestring budget. To produce a good film like that does require some input and some assistance. I think that is a very important role for the federal government to try to do.

Mr. CLINGER. Yes, Dr. Wambold.

Dr. WAMBOLD. I would like to add a comment to that.

I think not just in transportation but all the way through, at least in engineering, most of our graduate students are foreign.

In the transportation area, it has been four years since I had a Ph.D. student who was an American-born student. That is true throughout engineering, not just in transportation.

Mr. CLINGER. Now, do these students stay here or do they go home again?

Dr. WAMBOLD. Well, some stay here; but the majority go home. Half and half, I would say.

The problem is that the industry draws the Bachelor's Degrees right out of engineering to where there is not much motivation to go on for advanced degrees. You will find that our teaching staffs, as well as all of the Ph.D. students that are coming out, are increasingly foreign born.

Our department right now has more foreign-born nationals. That is not a bad thing, but it is turning out that we are having more and more foreign people on the teaching staff because they are the only ones that want to stay in the teaching area.

Mr. OBERSTAR. If the gentleman would yield. We held a hearing earlier on bridge safety, last fall actually. One of our colleagues on the committee asked a similar question of a panel on bridge design.

To our astonishment we found the response was that there simply are no new people going into bridge design engineering in this country. It is just not an attractive field for them, or they are making a choice to go elsewhere.

I mean, I find this shocking that no one is going into advanced academic research. I am a big believer, as I know Mr. Clinger is, in university-supported research, basic research.

This country is just too committed to the 30-day bottom line approach to everything that we do. What you do has to turn a profit around in 30 days or you are out.

That is not going to serve America in the long run. I have no fear making a statement like that at a land grant university which is dedicated to basic research.

I thank the gentleman for yielding.

Mr. CLINGER. Dr. Wambold, you mentioned something in your testimony that I was unfamiliar with. It may be that I should be familiar with it, but maybe you could explain it a little more.

When you talk about "first article bus testing," what does that mean?

Dr. WAMBOLD. You passed, under the highway Act—and this is presently under rule making by UMTA—in which case all new buses are to be tested—and the "new" is being defined. So, in some cases it may just be a piece of a bus. One of the questions is how much of a piece of a bus makes it a new bus rather than an old one; but the way the rule making did read was any bus that has not been in use—and the time is still to be established—that it then has to be tested in what is called the "first article bus test" which would be similar to what you would usually think of as a torture test for your car that is run.

It is to be run, and that data then needs to be reported—this is not a pass or no pass or fail test. It is simply a test that evaluates all the articles of the bus, much like a consumer agency might do. That data then goes with the bus whenever there is a bid to any agency where federal money is involved. Without that data, they cannot submit a bid against somebody else.

Mr. CLINGER. So, basically, the Altoona bus testing that you are going to be tied in with here, is "first article bus testing?"

Dr. WAMBOLD. That is what I mean by "first article." It is the first time it is going to be into public use.

Mr. CLINGER. Dr. Henry, what is your overall budget and how is it broken down in terms of federal, state, local, and private sector financing?

Dr. HENRY. This varies from year to year.

Last year we were about 60 percent federal funding, 30 percent state funding, and 10 percent private sector.

This will fluctuate, particularly if we undertake another cycle of testing at the test track. There are large dollars associated with that, and that is state funding. That counts under our state funding even though there are some HP&R funds, federal funds, used in it. That tends to distort the figures the other way because we hire truck drivers and a lot of technicians.

That ratio is a pretty good ratio, I think, based on the professional level.

Mr. CLINGER. Would that be similar to the other research institutes that are comparable to yours?

Dr. HENRY. Most of the other research institutes are more heavily funded by their own state. TTI, for example, a much larger percentage is state funds. John, maybe you know the figure. I don't. They do some federal research, but I think it is much more.

Dr. MASON. They have, I would say, probably, almost a fifty-fifty split.

Mr. CLINGER. What was TTI?

Dr. MASON. Texas Transportation Institute.

Mr. CLINGER. Oh, Texas. Okay.

Dr. MASON. Again, that varies depending on the type of program.

When the Texas Transportation Institute was into a lot of hardware testing where they "crash and bash," you can imagine. It may be one or two programs, but they are very large dollar programs.

So, it does vacillate; but Texas is one of those states that uses much of its highway planning and research dollars in their state for research. Other states do not take benefit of that.

Mr. CLINGER. You say about 10 percent is private sector at this point. Is there a potential for growth in that area, getting more partnership arrangements with the private sector?

Dr. HENRY. Yes. With the Ben Franklin program in Pennsylvania now, we have several projects. That tends to right now replace the—we had a very large IBM project the year before last.

So, I would see that that level would probably continue at about the 10 percent level.

Mr. CLINGER. You do not see it as a growth area for your effort?

Dr. HENRY. I see it increasing in dollar volume as the whole program is increasing.

Mr. CLINGER. But not as a percentage.

Dr. HENRY. But not in percentage. We are getting into some very large projects and the SHRP program and the University Transportation Centers program will bring in some additional private sector; but I think, on balance, that maybe 15 percent is a reasonable maximum.

Mr. CLINGER. In that regard, Dr. Thomchick, you talked about some public/private partnership on traffic congestion areas. Could you expand on that a little bit?

Dr. THOMCHICK. Actually, we are looking at some public/private partnerships for financing efforts to relieve traffic congestion. This is one of our advisory committee projects.

We are not focusing on the engineering aspect. Dr. Mason is also actually directing the project.

Pennsylvania has a Transportation Partnership Act that was enacted to encourage these public/private partnerships. We are looking at, actually, the implementation of that Act and comparing it with partnerships that exist outside the framework of the Act.

This research is very practically oriented. We would like to come up with some assistance for practitioners, people at the local level, local and state level, to sort through the various financial mechanisms.

Everything is done on a very ad hoc or case study basis, and we would like to come up with some systematic approach for evaluating the financial mechanism and applying it to particular traffic congestion or traffic management alternatives.

Mr. CLINGER. I guess my final question, Mr. Chairman, would be about the relationship between the Institute and/or institutes and AASHTO.

Is it an ad hoc basis or is it a working relationship? Are there working committees and so forth? What is the connection between you and AASHTO?

Dr. HENRY. We do not enjoy membership in AASHTO because we are not part of the State Highway Department.

We do, of course, participate in the NCHRP program which is funded by AASHTO. Through TRB we make recommendations for research to AASHTO for inclusion in the NCHRP program.

Mr. CLINGER. So, that is the way your findings would be incorporated into AASHTO standards?

Dr. HENRY. That is correct. Through TRB, primarily. I am chairman of one of the TRB committees now on Surface Characteristics, for example.

Mr. CLINGER. Right.

Dr. HENRY. We will be making recommendations to AASHTO for research then, to be incorporated into their research endeavors.

Mr. CLINGER. My last question is a very parochial question, but it relates to the fact that one of the things I am interested in is trying to promote the use of wood because we have a lot of it in the 23rd Congressional District.

I am interested if PTI or any of your fellow members in the Mid-Atlantic Universities Transportation Consortium have done any research in terms of increased usage of wood materials in transportation-related construction, such as bridges. Do you know of any work being done in that area at all? AASHTO has never promulgated any standards for the use of wood in the construction of bridges.

Dr. HENRY. We have had some inquiries as to the skid resistance of wooden bridge decks.

Mr. CLINGER. But that is it.

Dr. HENRY. We do not have much experience with it.

Mr. CLINGER. Well, I see I am going to have my work cut out for me to get that project moving. [Laughter.]

Dr. WAMBOLD. The only work that I could even offer is the Park Service does a lot.

In roads and bridges, but that is the only place.

Mr. CLINGER. Yes, I am aware of that and the Forest Service, too; but we would like to get some standards set by AASHTO because right now there are none. Therefore we are not building any wooden bridges. Sometimes they last longer than the other kind.

Thank you, Mr. Chairman.

Mr. OBERSTAR. I would share the gentleman's interest in wood fiber usage in highway materials. Representing northeastern Minnesota, we have two National forests and a billion board-feet a year of availability; but right now we are putting that into construction materials and paper.

Dr. Thomchick, you responded to this question, at least in part in answering Mr. Clinger's question; but your testimony refers to development of a public/private transportation partnership that would be applied to traffic congestion problems.

Could you elaborate on that a little bit? That intrigues me.

Dr. THOMCHICK. Perhaps I may call on Dr. Mason to assist me in this, since we are working on this project jointly.

The original project statement that we were doing for the committee was to look at traffic congestion problems, not necessarily from the point of view of resolving the problems but the approaches to financing.

Most of this would probably be capital projects: road improvements to relieve traffic congestion problems.

There is abundant literature on public/private financial approaches. Impact fees, assessments are among the most common. Those are more formal.

Then there are less formal arrangements where business, the private sector, will volunteer funds in order to make a road improvement that will allow them to develop in a particular area.

We would like to categorize the financial approaches, the public/private mechanisms, that can be used in these partnerships so that somebody at a local level, a township or municipality, would have a guide that would allow them to identify—well, they would have identified the traffic congestion problem that exists in the area—and would allow them to select the financial approaches that would work, the public/private partnership approaches that would be most appropriate for the particular problem.

Mr. OBERSTAR. Well, we would look forward to receiving that information as you develop it. I think that is a very important matter for us to be considering, in our long term review of infrastructure financing.

Likewise, Dr. Miller, I would like you to expand in writing, not now because we are running out of time; but your point on the decline in funding for transit research planning, I would like to have you focus on why that decline has occurred and what can we do to turn that around.

If you would submit that information, I would appreciate it.

Mr. OBERSTAR. I want to thank all the panel members, particularly Professor Meyer for returning after so many years, and to all of you for your hospitality and for the very generous sharing of information throughout this day.

Thank you all very much.

[The prepared statements of Dr. Henry, Dr. Anderson, Dr. Thomchick, Dr. Mason, Dr. Miller, and Dr. Wambold follow:]

STATEMENT PREPARED FOR THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT OF THE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION, HOUSE OF REPRESENTATIVES
JUNE 20, 1988

by

John Jewett Henry, Ph.D.
Professor of Mechanical Engineering and
Director, The Pennsylvania Transportation Institute
The Pennsylvania State University
University Park, PA 16802
814/863-1888

The Pennsylvania Transportation Institute, which was founded in 1968, is an interdisciplinary research institute of The Pennsylvania State University. Currently there are 45 faculty associates and 34 graduate students participating in research projects related to transportation. These researchers represent the departments of mechanical engineering, civil engineering, electrical engineering, business logistics, statistics, psychology, and meteorology. In addition, there are 15 support staff providing secretarial, financial, technician, and information services. The current value of research projects under way is approximately $5 million.

The Pennsylvania Transportation Institute has a national and international reputation for research. Earlier this month the Institute hosted joint meetings of the American Society for Testing and Materials Committee E-17 on Pavement Management Technology, and the Permanent International Association of Road Congresses (PIARC) Committee 1 on Surface Characteristics. Following these meetings the First International Symposium on Surface Characteristics was held in State College. Of the 158 registrants, 57 were from countries other than the United States. PTI faculty associates are leaders in many national and international societies; several have been active also in United Nations programs involving visiting fellows as well as missions abroad.

University transportation centers contribute significantly to the solution of national transportation problems. They provide a training ground for students working with faculty on research projects of interest to state and federal agencies. These students will be leaders in the transportation industry in the future. University transportation centers provide innovative, unbiased solutions to specific transportation-related problems by assembling interdisciplinary teams to address these problems.

The Pennsylvania Transportation Institute is a founding member of the Council of University Transportation Centers which consists of 36 member institutions. PTI leads a subset of six of these institutions in a regional university transportation center consortium (the Mid-Atlantic Universities Transportation Consortium). This consortium has proposed to become a University Transportation Center under the new program funded by the Office of the Secretary, U.S. Department of Transportation. This program will

provide $1 million in federal funds to a regional center in each of the ten federal regions. The four-year matching fund program will provide long-term support to universities for fundamental research.

The Pennsylvania Transportation Institute has been active in the Strategic Highway Research Program (SHRP), both during the planning stages and now during its execution. The Institute is currently serving as the prime contractor on two projects and as a subcontractor on a third. The University Transportation Centers Program and the Strategic Highway Research Program are four- and five-year programs, respectively. While they provide an outstanding opportunity for development, the university transportation centers must take a longer range view so that even when these programs have ended, the centers will continue their mission to produce high-quality research, disseminate the results of that research, and train future professionals.

STATEMENT PREPARED FOR THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT OF THE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION, HOUSE OF REPRESENTATIVES
JUNE 20, 1988

by

David A. Anderson, Ph.D.
Professor of Civil Engineering and
Director, Pavements and Materials Program
The Pennsylvania Transportation Institute
The Pennsylvania State University
University Park, PA 16802
814/863-1912

The need to rehabilitate our nation's infrastructure is readily apparent to those who use and depend upon the nation's highways and bridges. Concern about the source of funds to accomplish the needed rehabilitation, not only of the highway system, but also of other modes of transportation as well as water supply and sanitation systems, is continually being expressed by administrators and engineers at all levels of government. Little attention has been focused on the technical means to accomplish this rehabilitation in terms either of the materials and methods of construction or of the availability of properly trained and motivated personnel. To this end the nation's universities are a major resource by providing the training of engineers and managers and by the execution of research that provides new and innovative materials and methods of construction.

The need for an accelerated and intensified research effort in the highway area has been recognized by the highway community and the Congress in the initiation of the Strategic Highway Research Program (SHRP). This program, funded at $150 million over a five-year period, is a welcome initiative in the highway area. Undoubtedly, the research performed under this program will provide the highway community with a better understanding of the performance and behavior of asphalt concrete and portland cement concrete pavements and will suggest more effective maintenance strategies. Faculty at Penn State have been actively involved in the development of the SHRP research program and have been successful bidders for a number of studies contracted by the program. Dr. Thomas D. Larson of Penn State served as the chairman of the oversight committee which was responsible for developing the program, and several PTI faculty associates have served on the advisory panels for particular research areas.

Although we are certainly enthusiastic about the program, SHRP must be viewed only as a beginning and as a complement to other research and development activities of the Federal Highway Administration and of individual state departments of transportation. I believe that the program must be expanded to include other critical research areas such as crushed stone or gravel aggregates used in the highway system: these materials constitute the overwhelming volume of material in a bridge or pavement, yet almost no research funds are available for studying them. Other areas that need further research and development include improved techniques for quality assurance and pavement drainage, and improved opportunities for training and technology transfer. Although there are notable efforts under

way, many of these areas require the same kind of large-scale commitment being provided by SHRP.

The simple fact is that we have lost our technological lead in the highway area to other countries, particularly those of Western Europe. In a number of very significant areas we have fallen behind: no longer are we looked upon as the technological leaders as we were during the height of the Interstate Highway Program. As is the case in many other areas of technology, there must be greater effort expended in research and development in order to maintain the highway infrastructure. Granted, other areas of technology have important and justified claims to the available resources, but unless long-term resources are devoted to improving methods, materials, and management of the highway infrastructure, we will not provide the public with the optimum use of their tax dollars, and we will no longer be recognized as a leader in highway technology.

STATEMENT PREPARED FOR THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT OF THE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION, HOUSE OF REPRESENTATIVES
JUNE 20, 1988

by

Evelyn Thomchick, Ph.D.
Assistant Professor of Business Logistics and
Director, Transportation Policy Analysis Program
The Pennsylvania Transportation Institute
The Pennsylvania State University
University Park, PA 16802
814/863-3954

Transportation policy analysis has been an important area of research at the Pennsylvania Transportation Institute since the Institute was established in 1968. Research studies in the Transportation Policy Analysis Program focus not only on the condition of transportation facilities, but also on broader based issues that affect the planning and operation of transportation systems. Research in this program is generally inter-disciplinary and, over the years, has produced a mixture of financial, economic, legal, engineering, and management studies.

An important and unique part of the Transportation Policy Analysis Program is the research conducted for Pennsylvania's State Transportation Advisory Committee. This committee consists of thirty members, including the Secretary of Transportation, heads or designates from six other state agencies, legislators, and eighteen public members appointed by the Governor, the President Pro Tempore of the State Senate, and the Speaker of the State House of Representatives. The functions of the Committee are to undertake in-depth studies on key transportation issues, consult with and advise the Secretary of Transportation and the Transportation Commission, and serve as a liaison between the Department of Transportation and the public. The Transportation Policy Analysis Program serves the Committee in all three areas by providing research staff to conduct the Committee's studies (although personnel from other Institute programs may participate, depending on the topic), assisting the Committee in developing recommendations to be submitted to the Secretary of Transportation, and publishing reports on the studies.

Studies conducted for the Transportation Advisory Committee have encompassed a broad range of policy issues. One topic that has been examined frequently is transportation financing. Several fiscal reviews conducted for the Committee at different periods of time have resulted in significant recommendations to the Department concerning the financing of transportation programs. Transportation financing issues have continued to increase in importance because of the large federal budget deficit and the changing role of the federal, state, and local governments in transportation financing. The importance of transportation financing is reflected in the current projects being conducted for the Advisory Committee. In one project, PTI is developing a microcomputer-based highway cost allocation model for Pennsylvania. The model will produce user equity ratios that reflect user costs and revenue contributions for Pennsylvania's highways.

At least one more year will be required for full development of the model, but we expect that a working prototype will be available by the end of summer 1988. A second finance-related project is being worked on jointly by personnel from the Institute's Transportation Policy Analysis Program and the Transportation Operations Program. In this project, various approaches to transportation financing, particularly public/private transportation partnerships, are being investigated for application to traffic congestion problems.

Other recent projects in the Transportation Policy Analysis Program reflect major national transportation concerns. Two recently completed studies dealt with the motor carrier industry. One study focused on motor carrier safety, in particular on the efficacy of roadside inspections; the other examined the administration of motor carrier activities by state transportation agencies. A study of tort liability, completed by PTI in 1983, was the basis for the Department's tort liability risk management program.

The association of the Pennsylvania Transportation Institute and the Pennsylvania State Transportation Advisory Committee provides many benefits to both parties. The Advisory Committee and thus the Department of Transportation obtain research expertise in a variety of areas at an economical cost. On the part of the Institute, there are many academic benefits for the faculty and students involved, certainly in the form of publications and student projects, but, most important, in the exposure of faculty and students to current, realistic policy problems and the opportunity to make positive contributions to an active government organization.

The research for the Advisory Committee also provides the potential for expanding the projects undertaken for the state into projects at the national and international level. Unfortunately, decreased funding opportunities in transportation policy analysis at the national level have made these efforts more difficult than in the past. Two examples of funding opportunities that no longer exist are the U.S. Department of Transportation University Research Program and the Maritime Administration University Research Program. The latter program had relevance to the Transportation Policy Analysis Program, because we have initiated research on international transportation and logistics. It is disheartening and ironic that transportation policy research appears to be de-emphasized at a time when increasing transportation needs and decreasing transportation funding sources make effective management of transportation projects, resources, and agencies more important than ever.

STATEMENT PREPARED FOR THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT OF THE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION, HOUSE OF REPRESENTATIVES
JUNE 20, 1988

by

John M. Mason, Jr., Ph.D., P.E.
Associate Professor of Civil Engineering and
Director, Transportation Operations Program
The Pennsylvania Transportation Institute
The Pennsylvania State University
University Park, PA 16802
814/863-1907

I appreciate this opportunity to present my views on transportation-related research needs. There are three areas that I believe warrant special consideration in the future design and operation of the nation's streets and highways. These issues are:

1. Integration of Research Findings into Design Policies
2. Feasibility of Exclusive Truck Facilities
3. Continuing Education of Transportation Professionals

1. Integration of Research Findings into Design Policies

It has become common for the findings from design and operation studies to lag behind published policies and procedures by almost ten years. While the implementation of new findings needs to be carefully evaluated from the viewpoint of cost-effectiveness and safety, many findings are not adopted simply because the research results are not known by those preparing the recommendations for practice. Such a pattern is not deliberate, but occurs because funding is insufficient to critically review the multitude of related investigations, synthesize the pertinent results, and document the limitations of particular criteria or analytical methods.

When one considers the enormous investment in the design, construction, and operation of our highway system, it is perplexing that the national guidelines and policies on the geometric design of new facilities are assembled on almost a voluntary basis. The Surface Transportation Assistance Act of 1982 called for a study of the safety cost-effectiveness of geometric design criteria, and for standards to preserve and extend the service life of highways other than those which are fully controlled. The results were published in 1987 by the Transportation Research Board (Designing Safer Roads: Practices for Resurfacing, Restoration, and Rehabilitation). However, the integration of those findings will be left to the various task forces and committees of the American Association of State Highway and Transportation Officials (AASHTO) as they prepare the next version of the AASHTO Policy on Geometric Design of Highways and Streets. The new policy is applicable to resurfacing, restoration, and rehabilitation (3R) work or federal-aid highways in states that use new construction standards for 3R projects.

While the members of those teams must be commended for their accomplishments, the product of their efforts is limited by daily demands, limited support staff, and publication deadlines (necessary to provide a timely document). It is, therefore, not surprising that the critical review of related research must be limited.

Based upon the above observations, it is proposed that a detailed study be conducted of the current method of integrating operational and geometric research findings into future policies. The objective of such an investigation would be to recommend staffing and funding levels commensurate with the demands of critically reviewing related research results. Mechanisms to ensure input by practitioners and researchers should be developed. In addition, strategies are needed to effectively provide open hearings on the implementation of published national policies.

2. Feasibility of Exclusive Truck Facilities

The problems of larger trucks and smaller cars sharing the same roadway environment have been identified in past research efforts. These efforts have highlighted incompatibility in pavement structure and roadside safety features, operation/performance inequities, geometric deficiencies, differences in vehicle characteristics (e.g., the longer stopping distances required by trucks), and the great difference in crashworthiness between automobiles and large trucks. Related research has routinely reported the dilemma designers face in attempting to safely and economically accommodate both vehicle types on one roadway. However, very few studies have focused on the evaluation of the safety and cost-effectiveness of segregating the automobile and the truck. The feasibility of providing separate/exclusive truck facilities should be investigated, with special emphasis on the major elements of geometrics, right-of-way, operations, safety, and pavement salvage life on existing highways.

Currently, FHWA is identifying the critical truck characteristics affecting the design and operation of highways. This effort will establish the criteria appropriate for better accommodating large trucks in future designs. The analysis of unique truck facilities will be possible once the appropriate criteria are reported.

Exclusive truck facilities include: (1) designation of exclusive lane(s), (2) addition of uniquely constructed lane(s), (3) conversion of shoulder/median areas to serve through truck traffic, (4) rehabilitation of abandoned railroad right-of-way for exclusive truck haul (short or long distances), (5) the construction of elevated or depressed truck travelways, (6) exclusive truck routes, or (7) separate/isolated truck highways.

3. Continuing Education of Transportation Professionals

Several studies have been conducted to identify future transportation professional manpower needs. A 1985 study by the Transportation Research Board (Transportation Professionals: Future Needs and Opportunities) found that greater-than-average turnover is expected among most senior transportation professionals during the next decade. Many state

transportation agencies, local highway departments, and consultants have recognized that this situation will force the reconsideration of organizational structure, missions, and personnel needs. Among the most serious need is the initial and continuing education of the transportation professional.

Universities constantly work to keep curricula current and responsive. This is their mission, and such change is considered crucial to ensuring quality education. Governmental agencies, on the other hand, have greater difficulty in selecting, developing, and supporting a responsive continuing education program. Although numerous short-course programs are offered by professional societies, their cost may be prohibitive for agencies with a large number of employees.

An investigation of the curriculum needs of practicing transportation professionals should be undertaken which contains the following objectives:

1. Identify the core curriculum needs of representative transportation agencies.

2. Develop a coordinated on-going program of study to meet the identified curriculum.

3. Establish preferred instructional methods for the range of technical and nontechnical content.

4. Inventory existing and/or planned "total" education programs of various transportation agencies.

5. Identify means to share (rather than duplicate) already developed programs.

6. Prepare and conduct a 5-year demonstration project to test a comprehensive program with state support.

7. Monitor and assess the results of the established programs.

STATEMENT PREPARED FOR THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT OF THE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION, HOUSE OF REPRESENTATIVES
JUNE 20, 1988

by

James H. Miller, Ph.D.
Associate Professor of Business Logistics and
Director, Public Transportation Program
The Pennsylvania Transportation Institute
The Pennsylvania State University
University Park, Pennsylvania
814/863-1909

I am the Director of the Public Transportation Program at the Pennsylvania Transportation Institute, and an Associate Professor of Business Logistics in the College of Business Adminstration at The Pennsylvania State University. I also serve as Chairman of the Board of Directors of the Centre Area Transportation Authority, the local public transit provider for the State College and Bellefonte areas. In addition, I have been designated as the Director of the Mid-Atlantic Universities Transportation Consortium, a six-university consortium which has submitted a proposal to become the University Transportation Center for Federal Region 3.

Earlier this month I participated in a workshop on the State Role in Public Transportation, sponsored by the Transportation Research Board and the American Association of State Highway and Transportation Officials. The meeting, which was attended by high-level state and local transit officials, was convened to consider key issues related to the states' increasing role in the funding and direction of public transit. While most of the discussion focused on funding and program management, conference participants also identified two critical issues which I will address in my testimony today: the need for a continuing program of applied transit-related research and the need to respond to an increasingly critical shortage of new management talent for the transit industry. The future of public transit as a cost-effective public service depends on solving both problems. I believe that the federal government has a continuing role to play in confronting these programs, and that a major land-grant, research-oriented university such as Penn State also has an important role.

State and federal governments now spend over $7 billion a year on transit capital and operating assistance.[1] Although total public support of transit has increased dramatically over the past fifteen years, our commitment to transit research has declined dramatically. The Urban Mass Transportation Administration, the major supporter of transit research, has reduced its funding for transit research from about $60 million per year in the 1970s to about $22 million per year today.[2] The Federal Highway Administration provides a continuing and predictable source of funding for highway research and planning by annually setting aside a percentage of federal highway funds for these purposes. Transit research and planning, on the other hand, are declining as the need for these activities increases.

Though we can debate which level of government should most appropriately pay for capital and operating expenses, I believe that the federal government is the most logical sponsor of research that is of benefit to the entire transit community.

Two important steps have been taken to address the need for a continuing program of transit research. The first, the University Transportation Centers Program, provides for a four-year commitment of $5 million a year from the transit account of the Highway Trust Fund for university-conducted transit research. This is an important step in reestablishing the role of the university as a major contributor to transit research and should provide important new information that will benefit the transit industry. An equally important benefit of the program will be the support of students who will become the transit leaders of the future. I will say more about this point later. I appreciate the support that the Public Works and Transportation Committee has given to the Council of University Transportation Centers as we developed the plans for the University Centers Program and fashioned the legislation that established and funded this major research initiative. I urge your support of one remaining roadblock to the start-up of this effort--the authorization of the $5 million highway-funded portion of the program. The effectiveness of the University Centers concept will be severely limited if the full funding level is not achieved.

I also urge your support for the other major transit-research initiative, the proposal made by the Strategic Transportation Research Study: Transit (STRS:Transit),[3] that one-half percent of the Section 9 and Section 18 formula grant amount be set aside for an industry-directed program of operator-oriented, problem-solving research. Such a program would provide about $10 million a year for research in such critical areas as human resources management, service configuration and marketing, service delivery models, internal efficiencies, maintenance, equipment, and innovative financing. I recognize the need for research in the areas identified in the STRS:Transit report both as a university researcher and as a local transit policy maker. One specific example results from our work at PTI to formulate plans for the implementation of bus testing at the Altoona Rail Training Facility. As we work with UMTA to develop bus testing procedures, we realize that little research has been done on the development of testing procedures for large and small buses to ensure that they are capable of providing low-cost, dependable transit service over their expected lives. Research will be needed to develop the tests that will be conducted at the Altoona facility. Other equipment-related research that will benefit the industry can also be conducted there if funding is available.

The second issue that I wish to bring to your attention today is the need for programs to increase the supply of managerial and technical talent in the transit industry. Our ability to conduct relevant research and our ability to manage our transit systems depend on a steady supply of capable, well-trained people. Many of the state and local officials attending the conference I mentioned earlier, indicated that they are having increasing difficulty in filling professional positions and that the lack of qualified staff prevents them from carrying out their missions. Obviously, universities have a key role to play in providing future managers and

technical professionals to the industry. Programs such as the University Centers Program and the one advocated in the STRS:Transit report will provide funding that will support graduate students who, once trained, can enter the transit field and provide the needed human resources.

One area that I believe needs additional attention, and one in which there may be a federal role, is the expansion of training and internship programs for undergraduate students. Our local transit system regularly employs two or three Penn State student interns. Over the past five years, most of these students have pursued careers in transit and are already rising to important positions in transit agencies. I propose that future federal transit research and training programs specifically identify internship programs as a high priority activity and that transit agencies be encouraged to create internship and other real-world training programs so that we can attract and train the next generation of public transit leaders.

Again, I appreciate the opportunity to testify before you today, and I also appreciate your continued interest and support of public transit.

---

[1]John Dockendorf, "State Transit Funding Issues," Conference on the State Role in Public Transportation, Fredericksburg, VA, June 1-3, 1988, p. 1.

[2]Research for Public Transit: New Directions, Strategic Transportation Research Study: Transit, Special Report 213, Transportation Research Board, Washington, DC, 1987, p. 1.

[3]Ibid., pp. 62-65.

STATEMENT PREPARED FOR THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT OF THE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION, HOUSE OF REPRESENTATIVES
JUNE 20, 1988

by

James C. Wambold, Ph.D.
Professor of Mechanical Engineering and
Director, Vehicle/Surface Interaction and Safety Program
The Pennsylvania Transportation Institute
The Pennsylvania State University
Research Building B
University Park, PA 16802
814/863-1889

I appreciate this opportunity to bring to your attention two different aspects of transportation. The first concerns test facilities at PTI which can be made available to the government. The second topic involves the commuter airline industry.

I serve as the Director of the Vehicle/Surface Interaction and Safety Program. The studies in this program deal with the interactions between vehicles and pavement surfaces, particularly emphasizing skid resistance, road roughness, and tire characteristics. This program was established at Penn State even before the Institute was founded, and has been internationally recognized for its contributions to highway practice, for example, in the formulation of standard test methods for skid resistance.

One of PTI's outstanding facilities is its Test Track. This facility has a number of research capabilities: a pavement durability track, a truck escape ramp, skid and roughness testing and calibration sites, and an experimental bridge. In addition, this summer, we are beginning our program of crash testing.

Two additional possible uses for our facility are for bus testing and for vehicle testing. We have been discussing with the Urban Mass Transportation Administration the addition of a test lane to the existing test track to accommodate first-article bus testing. We have also had some discussions with the National Highway Traffic Safety Administration about a possible conflict of interest arising from its testing program at the Ohio Test Track in East Liberty. That facility has now been purchased by the Honda Corporation.

If resources from UMTA could be combined with those available from the University and the Pennsylvania Department of Transportation and possibly from NHTSA, a better facility could be built for the first-article bus testing (which would accommodate all the required tests), and testing for NHTSA would be feasible as well.

I propose that the expansion of the Penn State Test Track to accommodate UMTA's program of first-article bus testing, NHTSA's testing requirements, and FHWA's crash testing program be considered as a cost-effective use of government funds.

The second topic I would like to discuss today is the present state of the commuter airline industry. Many small towns are served by only one airline, usually a commuter airline, and thus deregulation has not helped to foster competition. If service is unsatisfactory, there is no alternative. Schedules are not always adhered to, and flights are frequently canceled. The usual reason given is maintenance problems. However, these cancellations often occur on Sundays and holidays. For example, the flights from State College to Philadelphia are almost always canceled on holidays. It is difficult to believe that the commuter service always has maintenance problems on holidays, especially when travel agents seem to know of such cancellations ahead of time.

I would like to suggest that consideration be given to regulating airlines to some degree. Particularly, I would like to see the commuter airlines surveyed with respect to delays and cancellations. I believe that the FAA should be required to keep statistics on the number of flights cancelled or delayed and the reasons for these occurrences, as is now done for major airlines. Without competition and in the absence of government regulation, the public is not being well served.

Thank you.

Mr. CLINGER. Mr. Chairman, I look forward to receiving the submissions from Dr. Miller and others.

Mr. OBERSTAR. Our next panel consists of Mr. Mark Knouse, Executive Vice President, International Barrier Corporation, accompanied by Mr. Lincoln Cobb, Head of Design for that company. Welcome.

(Panel sworn.)

Welcome to our hearing. We appreciate your taking the time to be here with us and share with the subcommittee, for our permanent hearing record, the development of a new concept in barrier construction and highway safety, something about which I have already had some information and an earlier presentation.

We welcome your participation here today, and please proceed.

TESTIMONY OF MARK KNOUSE, EXECUTIVE VICE PRESIDENT, INTERNATIONAL BARRIER CORP., WASHINGTON, DC, ACCOMPANIED BY LINCOLN COBB, HEAD OF DESIGN

Mr. KNOUSE. Mr. Chairman. Mr. Clinger. Thank you very much.

Given the lateness of the hour and knowing that you have been here, sitting quite some time, I will make my remarks brief. I will just summarize parts of our testimony.

Mr. OBERSTAR. The entire statement will appear in full in the record.

Mr. KNOUSE. Thank you, sir.

We do have a brief video tape that we would like to show through the course of the testimony, if that is acceptable given your time constraint.

Mr. OBERSTAR. Please go ahead.

Mr. KNOUSE. Thank you.

Again, my name is Mark Knouse. I am joined by my colleague Lincoln Cobb. We appreciate the opportunity to appear and to present testimony on behalf of the International Barrier Corporation. IBC is the inventor and patent holder of a new and, we think, revolutionary type of high median barrier.

The subject of this hearing on advances and trends in highway safety research and development is important to every aspect of the American driving public.

Passenger cars have become smaller and lighter over the past two decades and have lower, more aerodynamic frontal slopes.

Traffic barriers, however, have changed little since current systems were developed in the 1960s. There was a growing concern that changes in vehicle characteristics would adversely affect barrier performance, resulting in decreased protection for occupants of modern cars.

Highway accidents continue to represent a major problem in this country. Traffic accidents are still the leading cause of death for persons 37 years of age and younger.

Although many factors contribute to this toll, the roadside environment has clearly been identified as playing a major role in highway safety.

Quoting from "Transportation Issues 1987" prepared by the Highway Users Federation, emerging safety problems exacerbate the old ones. The automobile fleet is downsizing, but today's most

modern highways were designed for the larger, heavier cars of a generation ago.

Safety features built into highways, such as guard rails, barriers, and break away supports, may need a safety retro-fit to be forgiving to smaller and lighter vehicles in cases of collision.

One of the primary tools in reducing the severity of roadside accidents is the use of longitudinal traffic barriers which are intended to shield roadside hazards from impact by errant vehicles.

Although commonly used traffic barriers are designed to be less hazardous than the features they shield, they are certainly not immune from problems.

Many factors have been found to affect barrier performance. They are design and materials, highway geometrics, traffic speed, vehicle mix, and environmental factors.

It is especially these factors and the concern for the safest possible highway median system at an affordable price that prompted the design, development, and installation of the International Barrier Corporation steel sand-filled highway median barrier.

At this point I would like to just run the video tape, if we may.

[Video tape shown:]

1978. A car race through the streets of the city. On both sides of the—is a new barrier system designed to protect spectators and cars alike, a barrier system which took less than 72 hours to assemble.

The car has struck the barrier at high speed, each impact being safely contained. Result: no one injured on either side of the barrier.

After extensive development work, the IBC Mark 7 barrier came into being. Carefully engineered, the Mark 7 barrier consists of a series of easily assembled metal bins which are filled with sand and covered with a non-structural lid.

Both height and width can be varied to accommodate any traffic pattern or to encompass bridge piers and light standards; but the standard dimensions are 42 inches by 44 inches, with a base width of 28 inches.

The half panels which form the sides of each bin overlap to provide a double thickness of steel and bumper height, and beam stiffness is accomplished with corrugated metal and a bulge profile.

The steel bins do not require any posts or supports, and the barrier is not anchored to the ground at any point around its length.

Corrosion is prevented through the use of galvanizing or colored plastic coating.

Once filled with sand, each bin weighs 1100 pounds per running foot; but the single heaviest component, other than sand, is the 120 pound half panel.

The IBC Mark 7 barrier tailors its response to the severity of impact. In this test, a laden-mini weighing 1670 pounds impacts the barrier at 69 miles per hour at an angle of 20 degrees.

As the mini strikes the barrier, the sand provides the support required to allow the panel to de-form only as much as is needed for a safe re-direction.

Control of vehicle dynamics are extremely good throughout. Since small cars are very common on our highways, this aspect of the barrier's performance is most important.

During an earlier test using a New Jersey para-fit barrier, extended upward in an effort to improve performance, a laden-mini impacted at an identical speed and angle as the Mark 7 test.

A test using a 2,000 pound car at 59 miles per hour and a 15 degree angle, highlights the performance of the IBC barrier.

The vehicle was lightly damaged and driveable after impact. This impact is typical in vehicle-to-barrier contacts, and yet damage is almost nil.

Most minor incidents of this type require no maintenance of the barrier.

As with the laden-mini, this car remained precisely in the same plane throughout the test. All four wheels firmly on the ground, with negligible roll nor pitch.

Shaped concrete barriers which are in common use today can impart shocking dynamics to small cars giving them high roll angles, overturning them, or lifting them off the ground for distances of over 30 feet.

A 4500 pound car at 62 miles per hour and a 25 degree angle demonstrates another aspect of the IBC barrier performance.

There is more permanent deformation of the barrier, accompanied by a substantial compaction of the sand as the energy of impact is absorbed. Under normal conditions, the non-structural lid will contain the sand. Again, the vehicle remained on all four wheels.

When deflection reaches a certain point, sufficient tension is built up along the barrier to begin to contribute significantly to re-direction.

This aspect of the IBC barrier performance is very important in control of the vehicle during impact.

A test performed with a 4500 pound car using New Jersey shaped concrete barrier underscores the difference. *Speed: 60 miles per hour. 25 degree angle.*

Accelerations with the concrete barrier were recorded as 6.2 Gs longitudinal and 14.1 Gs lateral, while the IBC Mark 7 barrier produced 6.5 Gs longitudinal and 9 Gs lateral.

The ultimate stage of performance in the Mark 7 test is reached with larger vehicles.

A British motor coach, ballasted into 19,000 pounds, impacted at 47 miles per hour and 15 degrees. Result: a very low roll angle and little damage.

This school bus was ballasted to 20,000 pounds and struck the IBC barrier at 53 miles per hour and 15 degrees.

School buses are extremely difficult test vehicles because of their high centers of gravity and the fact there is no structure other than the under carriage which is low enough to interact with highway barriers.

The bus remained upright through the test. The barrier moved 10 inches across the ground while the side of the barrier, in direct contact with the vehicle, was deflected 20 and a half inches.

An enormous amount of energy was absorbed, while accelerations were kept low.

An FHWA test using concrete barrier shows that the bus is virtually airborne at one point. This impact took place at 60 miles per hour and 15 degrees.

The New Jersey barrier produced peak accelerations of 1.7 Gs longitudinal and 5.7 Gs lateral.

The IBC Mark 7 barrier test produced accelerations of 1.4 Gs longitudinal and 2.8 Gs lateral.

The wide performance range of the IBC Mark 7 barrier is well-demonstrated by these tests. From the lightest impact to the most severe, the IBC barrier performance is excellent, softening impact and improving chances for taller vehicles to be re-directed without overturning.

It is these characteristics which give the IBC barrier a very forgiving nature.

Direct from Paris shaped concrete barrier and the IBC Mark 7 barrier highlights some interesting findings.

Shaped concrete barrier consistently elevates impacting vehicles. Once in the air, there is no way of knowing whether or not the vehicle will overturn or gain the severe yaw angle or enjoy good re-direction.

Whichever occurs, it is unlikely that the driver will have control of the vehicle once it falls back to the road surface.

International Barrier Corporation has revolutionized highway barrier technology, with performance demonstrated through extensive testing on two continents.

Truly a new highway barrier.

[Video tape concludes.]

Mr. KNOUSE. Thank you. I appreciate your indulgence.

Mr. OBERSTAR. That was good.

Mr. KNOUSE. To an extent, our appearance before this subcommittee is a bit like preaching to the choir.

The two states that have given the most attention to the IBC median barrier are Mr. Oberstar's Minnesota and Mr. Clinger's Pennsylvania.

In fact, it was another member of your subcommittee, Bud Shuster, that was critical in convincing Pennsylvania to test the IBC barrier, both on PennDOT maintained highways and on the Pennsylvania Turnpike.

Since that time, ten states have installed or committed to install IBC barriers for testing purposes.

In November of 1987, the Federal Highway Administration authored a memorandum to FHWA regions requiring states to show a

technological and economic analysis on all construction jobs that include highway median barrier and utilize federal funding.

The IBC barrier is specifically an example of new technology worthy of consideration of testing.

In the memorandum, the states were asked to consider and compare the cost of site preparation of the IBC barrier versus the more commonly used concrete barrier.

We realize that the IBC barrier will not be a panacea for all highway accidents. It will, however, contribute greatly to curtail certain types of accidents.

In the deliberations of this subcommittee in hearing testimonies from numbers of individuals and groups, we feel that highway safety, considering it and evaluating it, and employing the latest advances in safety technology, is critical to the future of the U.S. driving public.

It is that concern for the safest, most efficient, highway system possible that prompted our participation in today's hearing.

In closing, we wish to thank Chairman Oberstar and Mr. Clinger for the interest and attentiveness today.

Because of your reputation for thorough evaluation of new products and concern for the safety of the American driving public, we could ask for no better forum.

After the subcommittee has had an opportunity to review our technical-information and our testimony, we will be happy to clarify any remaining points, answer any questions, or appear in other similar forums throughout the country.

I would now be happy to answer any questions you might have.

I just would like to add, on a personal note, Dick Tearle and Ed Feddeman have been extremely helpful in working with us and giving us the opportunity to present testimony today.

Thank you.

Mr. OBERSTAR. Thank you very much, Mr. Knouse.

We had hoped that time would permit us to actually see the barrier that you developed. Regrettably, time does not allow that.

Your demonstration of an in-place barrier is too far away, but we will make it a point to see that at some time during this year.

The site preparation, installation, and construction costs, I guess, are kind of starting points for us. Leaving aside for the moment the already visually demonstrated effectiveness of the barrier in absorbing energy and deflecting a vehicle in a safe manner, what are the comparable costs of construction for a concrete shaped barrier and the IBC barrier? Differentiate between site preparation for IBC and a shaped concrete barrier.

Mr. KNOUSE. Mr. Oberstar, I am going to ask my colleague Lincoln Cobb to field that question. He is the designer of the barrier.

Mr. COBB. Thank you. I think I will use an example as the basis for answering your questions, Mr. Chairman.

On the particular project that our barrier was installed on, the concrete barrier was the alternative. The actual line item for the cost of the concrete barrier was substantially lower than the line item for the physical cost of our barrier.

The net cost of the projects were almost the same. In this particular case, what was put on the line item was about $17 a foot for the concrete barrier and about $28 a foot for our barrier for the

barrier alone. Yet, the project costs were about $60 for concrete and about $57 for the IBC barrier.

How this happens is that it stands basically on the fact that the IBC barrier does not require a great deal of preparation of the ground.

As mentioned in the film, the IBC barrier is not anchored. So, a reasonably level surface is basically all that is required.

It is very insensitive to the cross slope, to the angle of the surface on which it rides.

It has so far been installed on a grassy median, directly on the side. It has been installed on existing asphalt where a previous barrier was torn up, the holes patched, and the barrier put down. It has been installed in Florida on an exposed aggregate sub-base, which would simply allow it to be on the surface.

So, it functions well in each of those circumstances. It needs just a basically level surface.

A concrete barrier, to function at its best, should be on a firm surface. It should in some way be prevented from shifting laterally.

In construction site applications at times, it is placed without anchorage; but for a permanent full performance application of a concrete barrier, it should be keyed in place in some way. There are many ways of doing it.

Finally, the approach to a concrete barrier is quite critical to its performance. You saw in the films there, the performance of concrete barrier under, if you will, ideal circumstances. That was laboratory conditions.

What has been found is that relatively small variations in the slope approaching a concrete barrier can make a marked difference in its performance, generally for the worse.

So, where IBC may in some cases have an advantage in site preparation is in all of these elements, in the fact that an existing median may be perfectly suitable for the application of an IBC barrier; whereas there are certain minimums in the shape of the median, in the surface on which the barrier will be placed, that are required for a concrete barrier.

Mr. OBERSTAR. My understanding of this product is that its cost per linear foot is higher than that of concrete barrier, but site preparation is substantially lower than that for concrete barrier.

What are the cost differences per linear foot for a shaped concrete barrier versus the IBC sand-filled barrier.

Mr. COBB. Well, in fact, it is sometimes difficult to be very specific.

We can work backwards from the example that I cited before. In fact, we cannot say how a contractor has divided up their costs; but we do note that there are instances where our barrier, at $28, on a final job cost basis is competitive with concrete at $17.

The honest truth to it is I cannot say exactly where those costs come in.

Mr. OBERSTAR. But there is a cost differential. If you have to do footings for a concrete barrier, pour concrete for the footing, anchor it, set up your mold to pour the concrete for the barrier itself, you have some sunk cost; whereas in the case of your barrier, you do not have that site preparation.

If highway departments, however, insist on the same type of subbase preparation for the sand-filled barrier as they do for the concrete shaped barrier, then the advantage of this new technology is compromised.

Mr. COBB. That is correct.

Mr. OBERSTAR. I will withhold at this point. Mr. Clinger.

Mr. CLINGER. Thank you, Mr. Chairman. Thank you, gentlemen, for a very interesting presentation.

I only have a couple of questions.

One is does this take up more space than the Jersey barrier in terms of land displacement?

Mr. COBB. Yes. The IBC Mark 7 barrier is 44 inches in overall width. I will say the conventional New Jersey barrier, the one that we see most commonly in place now on our highway systems, is 24 inches in total width.

Now, more and more often, you see a slightly thicker concrete barrier being installed; but there still will be a difference.

I think this reflects back to something that Mark said in his prepared testimony. This is no more a panacea than any other single piece of technology that is out there. There are places where, pure and simple, this new one is not going to fit; and concrete barrier may be the only technology available, given the geometry of a piece of highway.

Mr. CLINGER. It would seem to me that we have a lot of cases where we need temporary barriers. We put them down; then pick them up. Out here on Route 80, the Jersey barriers are omnipresent.

This would not have a temporary application, would it? It seems to me it is more of a permanent installation. It would be pretty difficult to put these things down and fill them with sand, and then a week or so later take all the sand out and take them away again.

Aren't you looking at this more as a permanent application than temporary?

Mr. COBB. We are looking at it predominantly as a permanent application.

Interestingly, quite a number of construction departments, on seeing our initial presentation, have pushed us in the direction of that temporary application. The reason being that they can get a lot of the components on site with very few conveyances. About 800 feet of the structure itself can be brought on site with a single truck, whereas the concrete barrier sections take a lot of room to store and not too many of them can be brought on site.

So, there is a certain appeal to them. We are focusing now on the permanent application.

The other place where interest in the temporary use has been, has stood, is on the fact that it may be the only technology that performs exactly as well as a temporary barrier as it would in a permanent installation.

It is nothing more than labeling as far as the function of the barrier is concerned. That is very appealing.

Mr. CLINGER. I think as both Mr. Oberstar and I are members of the Congressional Steel Caucus, this certainly has great appeal to members of the Steel Caucus. I could see that we could use quite a lot of steel in this kind of an application.

Thank you, Mr. Chairman. Thank you, gentlemen.

Mr. OBERSTAR. What we saw in the film presentation was, in essence, a laboratory type application.

If the barrier is hit with sufficient force, a large truck careening down a highway—let's say an 18-wheeler that rams the facility—is it possible that the barrier, the sand, can be pushed out into the roadway or the oncoming lane, the opposite of the median? Do you have any experience with that type of occurrence?

Mr. COBB. We have three field occurrences of heavy vehicle impacts, two with tractor trailers and one with a very large straight truck that we believe hit at about 35,000 pounds.

In no case was the barrier actually pushed into opposing traffic lanes. Part of the function of the barrier, the design purpose of the barrier, is that if it is hit hard enough it will shift a bit. The reason for that is that with a vehicle with high center of gravity, one of the greatest hazards is overturning over a rigid barrier.

Just as we might fall stubbing our toe on a concrete curb jogging in the evening, if a barrier cannot move and something with a high center of gravity hits it, it can go over.

In those very rare occurrences—I mentioned three out of in excess of a 1,000 total impacts that have occurred on this barrier since its first installation—in those very rare, severe occurrences, we have taken the position that it is preferable to keep the vehicle on the correct side of the barrier and generally upright.

Even if—it has not happened yet—but even if there might be some slight intrusion into the opposing traffic lane, when it is the same impact with another barrier could yield a truck on its side on the opposite side of the barrier, going into opposing traffic.

So, if the barrier still exists as a barrier—we are not trying to say it is good to have a barrier intrude a few inches into opposing traffic, but the alternatives are even worse.

Mr. KNOUSE. As an aside, we are also about to conduct, I would say within the next three months, a series of tests on 80,000 pound semis at the Texas Transportation Institute upon a version of the barrier, an expanded version of our barrier.

We have run all the numbers, if you will; and now we are going to do the field testing. We think that this barrier will, in fact, stop an 80,000 pound semi going 50 miles an hour. If that is true, it is unheard of.

Mr. OBERSTAR. Apart from displacement somewhat there and venting of the steel, the re-positioning or reconstructing of it would seem to me to be a relatively minor technological feat. You do not have to go out and pour concrete, do you? I mean, you simply go out and replace that one panel and move the sand back, pour it into the cavity.

Mr. COBB. In fact, in one instance, Mr. Chairman, the innovative thinking of the local maintenance department made that process even easier.

They went out and looked at the back side of the impact; then called on one of their crews to bring a small truck and a piece of 4 by 8 hardwood plank out to the site. They simply pushed the back, back into place, without loosening the bolts.

Once they had re-established the line, they were able to schedule the rest of the maintenance about two weeks later on their own schedule.

Mr. KNOUSE. Even the most severe cases we have thus far, and we are cognizant of this, too, the least amount of time that a maintenance crew is out there exposed to both lanes of traffic, if you will, our barrier can be replaced in the severer situation very quickly.

Mr. OBERSTAR. The Federal Highway Administration has reviewed the data, as I understand it, of your product and has certified or given it approval for its inclusion as an alternative or in various applications by state highway departments for barrier construction. Is that correct?

Mr. KNOUSE. Yes, sir. That is correct.

Mr. OBERSTAR. The committee very much appreciates your participation in the hearing and the presentation of this information, as well as the very dramatic video display.

We will follow further developments. I think we would like to hear from the Federal Highway Administration and other state highway departments in the application of this technology. It seems to be another stage, just as the shaped concrete barrier was a development that resulted in large part from hearings conducted by this subcommittee as a new leap in technology and highway safety. There have been developments in vehicle design and downsizing of vehicles that maybe indicate this is time for another technological leap forward with the facility and the product that your company has developed. We appreciate your bringing it to our attention.

Mr. KNOUSE. Thank you for the opportunity.

Mr. CLINGER. Thank you.

[Mr. Knouse's prepared statement follows:]

June 20, 1988

Good afternoon. My name is Mark Knouse and with me is my colleague Lincoln Cobb. We appreciate the opportunity to appear before the House Subcommittee on Investigations and Oversight to present testimony on behalf of the International Barrier Corporation. IBC is the inventor and patent holder of a new and, we think, revolutionary type of highway median barrier.

The subject of this hearing on advances and trends in highway safety research and development is important to every aspect of the American driving public.

In States such as Pennsylvania and Minnesota, with the interstate and primary roadway system almost completed there are few ways to cope with the increased traffic congestion. One is to widen the existing highways to accommodate more traffic lanes and a higher volume of vehicles. Where new construction or widening is impossible, increased action must be taken to make those existing highways as safe as possible.

Passenger cars have become smaller and lighter over the past two decades, and have lower, more aerodynamic frontal slopes. Traffic barriers, however, have changed little since current systems were developed in the 1960's. There is growing concern that changes in vehicle characteristics will adversely affect barrier performance, resulting in decreased protection for occupants of modern cars.

INTERNATIONAL BARRIER CORPORATION

Suite 200
800 Fifth Avenue
New York, New York 10021
(212) 791-0311
Telecopier (212) 751-0003

Suite 300
Washington Harbour
3050 K Street, N.W.
Washington, D.C. 20007
(202) 944-4260
Telecopier (202) 944-4251
Head Office

35 Jarvis Street
Toronto, Ontario
M5E 1N3
(416) 863-6344
Telecopier (416) 863-9523
Telex 06-218189

Highway accidents continue to represent a major problem in this country. Traffic accidents are still the leading cause of death for persons 37 years of age and younger. In 1985 alone, traffic accidents claimed over 46,000 lives with attributable direct economic costs in excess of $50 billion.

Today a highway injury occurs every 10 seconds and a highway fatality occurs every 10 minutes. At those rates, 75,000 Americans will die on our highways each year at the turn of the century.

Although many factors contribute to this toll, the roadside environment has been clearly identified as playing a major role in highway safety. Nationwide, about 36% of all fatalities result from collisions with roadside objects--on interstate highways this figure increases to nearly 50 percent. We can only expect those numbers to increase with the 4-5% rate of growth in highway travel each year.

Quoting from "Transportation Issues 1987" prepared by the Highway Users Federation: "...emerging safety problems exacerbate the old ones. The automobile fleet is downsizing, but today's most modern highways were designed for the larger, heavier cars of a generation ago. Safety features built into highways such as guardrails, barriers, and breakaway supports may need a safety retro fit to be forgiving to smaller and lighter vehicles in case of collisions..."

One of the primary tools in reducing the severity of roadside accidents is the use of longitudinal traffic barriers, which are intended to shield roadside hazards from impact by errant vehicles. Although commonly used traffic barriers are designed to be less hazardous than the features they shield, they are not immune from problems.

Many factors have been found to affect barrier performance--their design and materials, highway geometrics, traffic speed, vehicle mix and environmental factors.

It is specifically these factors and the concern for the safest possible highway median barrier system, at an affordable price that prompted the design, development and installation of the International Barrier Corporation's steel, sand-filled highway median barrier.

The sand-filled barrier was designed to reduce impact severity and eliminate vehicle overturns. From results of studies conducted on the performance of the sand-filled barrier both in the United States and Canada, conclusive statistics are evident in the lessening of cost and damage as compared to the more widely used concrete median barrier.

In one study conducted in Broward County, Florida on a portion of I-95, one mile of the steel, sand-filled barrier was installed in the Summer of 1983. The barrier was

installed in the middle of an 8 3/4 mile stretch that previously had no barrier. This section of I-95 was averaging almost a fatality a month. For purposes of comparison, the one mile of sand-filled barrier was adjoined to 7 3/4 miles of New Jersey shaped concrete median.

The Florida Department of Transportation in measuring accident severity and calculating accident costs from the period of May 1983 to November 1984 released the following results:

Average vehicle damage of those accidents involving both types of median barrier were: $1,246 in damage to those vehicles impacting the I.B.C. barrier and $2,386 for those vehicles impacting the concrete median barrier. The shape and covering material of the IBC barrier are the significant factors in reducing costs. Injury severity was the same for both the IBC barrier and the concrete median barrier.

One of the most significant statistics were the six accidents in which the vehicles overturned. All six were along the concrete barrier. These were severe accidents. Half were the type where the vehicle climbs the wall and overturns. The others were caused by vehicles bouncing off the wall, rotating, and when the vehicle was at a right angle to the direction of force, overturning.

The Florida D.O.T. report states that the IBC barrier requires less force to displace, and thus an accident will less likely result in a fatality. The IBC barrier slope and material greatly inhibit the changes of a vehicle and reduce vehicle damage on low angle hits.

To a great extent our appearance before this subcommittee is a little like preaching to the choir. The two states that have given the most attention to the IBC median barrier technology and the greatest number and variety of test sites are Mr. Oberstar's Minnesota and Mr. Clinger's Pennsylvania.

In fact it was another member of your subcommittee, Bud Shuster that was critical in convincing Pennsylvania to test the IBC barrier on both PENNDOT maintained highways and on the Pennsylvania Turnpike.

Since that time, Minnesota, New Mexico, West Virginia, Virginia, Colorado, Texas, Arizona and Iowa have installed or committed to install IBC barrier for testing purposes.

In November of 1987, the Federal Highway Administration authored a memorandum to all F.H.W.A. regions requiring states to show a technological and economic analysis on all construction jobs that include highway median barrier and utilize Federal funding. The IBC barrier is specifically cited as an example of a new technology worthy of consideration of testing. In the memorandum, the states were asked to consider and compare the cost of site preparation of

the IBC barrier verses the more commonly used concrete barrier. A copy of the memorandum is enclosed in our testimony submitted prior to today's hearing.

We realize that the IBC barrier will not be a panacea for all highway accidents, it will, however, contribute greatly to curtail certain types of accidents.

In the deliberations of this subcommittee in hearing testimony from numbers of individuals and groups we feel that highway safety--considering, evaluating and employing the latest advances in safety technology is critical to the future of the U.S. driving public.

It is that concern for the safest, most efficient highway system possible which prompted our participation in today's hearing.

In closing, we wish to thank Chairman Oberstar and Mr. Clinger for their interest and attentiveness today. Because of your reputation for thorough evaluation of new products and concern for the safety of the American driving public, we could ask for no better forum.

After the subcommittee has had the opportunity to review our technical information and our testimony, we will be happy to clarify any remaining points, answer any questions, or appear in other similar forums throughout the country.

We will now be happy to answer any questions that you might have.

Mr. OBERSTAR. The chair would like to express appreciation to the gentleman from Pennsylvania, Mr. Clinger, and to his staff, and to the Penn State administration, faculty and the Transportation Institute personnel who have really outdone themselves in hospitality, technological information and support services, to make this hearing an information chock-filled day for the committee and for our staff.

I want to thank you very, very much for making this such a productive session as we begin again our inquiry into highway technology and transportation research.

Does the gentleman have any further comment?

Mr. CLINGER. Thank you very much, Mr. Chairman. Just my thanks to you again for bringing the subcommittee to State College.

I think I agree with you: we have gotten a lot of very good information out of this session today.

Mr. OBERSTAR. The subcommittee stands adjourned.

[Whereupon, at 4:00 p.m., the subcommittee was adjourned.]

○

89-337 (68)